REPORT

ON THE

CHOLERA OUTBREAK

IN THE PARISH OF

ST. JAMES, WESTMINSTER,

DURING THE AUTUMN OF 1854.

PRESENTED TO THE VESTRY

BY

The Cholera Inquiry Committee

JULY 1855.

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1855.

CONTENTS.

DESCRIPTION OF MAP.

This Map is the same as that which illustrates the Report of Messrs. Fraser, Ludlow and Hughes on the Cholera outbreak in this district. It is founded on the Map published in Mr. Cooper's Report to the Commissioners of Sewers; but St. Anne's Court and the neighbourhood have been added to it, and the fatal attacks which occurred in the district throughout the whole epidemic have been inserted in their respective localities where these could be accurately determined. Further explanations are given on the Map.

INTRODUCTION.

THE Cholera Inquiry Committee appointed by the Vestry of St. James's, Westminster, upon the motion of Dr. Lankester, seconded by Mr. Joseph Brown, "for the purpose of "investigating the causes, arising out of the "sanitary condition of the Parish, of the late "outbreak of Cholera in the districts of Golden "Square and Berwick Street," entered upon its duties on November 25th, 1854; and, having held altogether fourteen meetings, completed its labours on July 25th, 1855, by adopting the accompanying Report.

Including certain members added at different times to its original number, the Committee finally consisted of the following Gentlemen :—

Messrs. CRANE and RICE, *the Churchwardens.*

*Rev. T. BEAMES.	*Dr. KING.
Mr. BIDGOOD.	Dr. LANKESTER.
Mr. BROWN.	*Mr. MARSHALL.
*Mr. FRENCH.	*Mr. SANDFORD.
Mr. GEESIN.	*Dr. SNOW.
Mr. HARRISON.	Mr. WATKINS.
*Mr. JAMES.	*Rev. H. WHITEHEAD.

* Subsequently added to the Committee as originally appointed.

Mr. York was requested to undertake the duties of Secretary.

For the purposes of this inquiry the Committee availed itself of the following sources of information. 1.—The Report of the Committee of Health and Sanitary Improvement appointed by the Vestry of St. James's in 1848. 2.—A Report by Mr. E. Cooper to the Metropolitan Commissioners of Sewers on the state of the Drainage in the localities affected by Cholera, containing a map of the Sewers, &c., September 1854. 3.—The Rev. Henry Whitehead's narrative, entitled "The Cholera in Berwick Street," 1854. 4.—Report on the Well Waters of the Parish of St. James, by Dr. Lankester, 1854. 5.—Dr. Sutherland's Report on Epidemic Cholera in the Metropolis in 1854, published in January 1855. 6.—Various Returns issued under the authority of the Registrar-General.

Besides consulting these published documents, the Committee obtained from the office of the Registrar-General a Return of the House-population in the districts of Golden Square and Berwick Street, according to the Census of 1851; and from the local Registers, through Mr. Buzzard the Vestry Clerk,

as well as from various Hospitals, documents to aid in forming an estimate of the extent and severity of the epidemic.

An early application was also made to Sir B. Hall, the President of the General Board of Health, for such information as might be at his disposal, relating to the Cholera outbreak in this Parish, but, principally on the ground that investigations of this kind were more valuable when independent, the President did not comply with this request.

More recently, in conjunction with Messrs. Fraser and Ludlow, two of the local Inspectors appointed by the Board, a deputation from the Committee endeavoured to construct as correct a chart of the deaths in the affected districts as could be made. By permission of the Board, the Committee has been enabled to obtain from the Lithographers some impressions of this map to illustrate the present Report.

The first attempt of the Committee to collect local information in the Cholera districts was by means of a printed Inquiry Return distributed to each house, with a request that it might be filled up by the occupier. This measure did not produce the anticipated results.

At the desire of the Committee, Dr. Snow,

on December 12th, 1854, laid before it a Report, containing an account of his researches already made on the supposed influence of the well water from the public pump in Broad Street, in producing the Cholera outbreak in its neighbourhood. The Committee have considered this document sufficiently important to be added at length to its Report.

A subsequent attempt to obtain local information, by a house to house visitation, was more successful. By the assistance of a printed form, or "Visitors' Inquiry List," prepared by Drs. King, Lankester, and Snow, the following streets were visited by the undermentioned members of the Committee :—The Rev. Thomas Beames, Mr. James, Dr. King, Dr. Lankester, Mr. Marshall, Mr. Sandford, Dr. Snow, and the Rev. H. Whitehead, viz. :—Broad Street, Marshall Street, Bentinck Street, part of Berwick Street, Kemp's Court, Peter Street, Green's Court, Husband Street, Hopkins Street, New Street, Pulteney Court, Cambridge Street, and part of Silver Street, containing in all 316 houses.

This "Visitors' Inquiry List," a copy of which will be found in the Appendix, contained twenty-two heads or subjects of investigation, on each of which exact information

was desired. The lateness of the inquiry,—the departure of many families from the neighbourhood,—the imperfect recollection of some,—the reluctance to reply on the part of others,—and the impossibility of underground research,—are circumstances which all interfered with the completeness of this local investigation. Its results, which may serve as a guide in any subsequent inspection, have been tabulated by the Secretary, in a form corresponding with that adopted by the Committee of Health and Sanitary Improvement in 1848.

In the hands of one member of the Committee, the Rev. H. Whitehead, whose previous knowledge of the district both before and during the epidemic, owing to his position as Curate of St. Luke's, Berwick Street, gave him unusual advantages, the Visitors' Inquiry elaborated itself into a most minute and painstaking investigation of a principal street, situated in the very heart of the locality affected. His special Report upon Broad Street the Committee have thought it necessary to append at length.

In consequence of facts ascertained by Mr. Whitehead, instructions were given to the Secretary, Mr. York,—whose practical experience entitles his evidence to complete

acceptance,—to inspect the cesspool and drains of the house, No. 40, in Broad Street, close to which the public pump is situated, and also to open and examine the well itself and the soil intervening between it and the drains and cesspool. Mr. York's statement, accompanied by a plan and section, is also annexed to this Report.

The analysis of six specimens of surface well water, the composition of which it was desirable to ascertain, was conducted in the Birkbeck Laboratory, at University College, by Messrs. Powell, Ormsby, Smith, and Worsley, at the request of Professor Williamson.

Lastly, many of the facts and statements in the following pages depend on the authority of individual members of the Committee.

The drawing up of the Report was entrusted to Mr. Marshall.

It is arranged under the four following heads :—1. History of the outbreak. 2. Circumstances attending the outbreak. 3. Hypotheses concerning the outbreak. 4. Recommendations of the Committee to the Parochial Authorities.

GENERAL REPORT.

HISTORY OF THE OUTBREAK.

The Parish of St. James, Westminster, occupies an area of 164 statute acres. At the census of 1831, it contained 37,053 inhabitants; in 1841, 37,457; and in 1851, 36,406. Its population may therefore be said to be nearly stationary; the small diminution since 1841 being probably owing to public improvements, especially to those made in connection with the building of the Museum of Economic Geology in Jermyn Street.

For the purposes of Registration, the Parish is divided into three sub-districts, viz. St. James's Square sub-district, occupying 85 acres, with a population of 11,469; Golden Square sub-district, extending over 54 acres, and numbering 14,139 inhabitants; and Berwick Street sub-district, having an extent of 25 acres, and a population of 10,798. Since 1841, the population of St. James's Square sub-district has decreased, whilst that of the other two districts shews a slight increase.

The parish is immediately surrounded by the following registration sub-districts :—May Fair and Hanover Square, in St. George's Parish, on the West; All-Souls, Marylebone, on the North; St.

Anne's, Soho, on the East; and Charing Cross, in St. Martin's-in-the-Fields, on the East and South.

1832. In the first visitation of Cholera in 1832, the parish of St. James, then numbering 600 more inhabitants than in 1851, suffered in only a moderate degree in comparison with many others, and on the whole somewhat later in point of time. The earliest deaths in the parish took place in March, and then the epidemic, subsiding until July, reappeared and continued during August, September and October. The total number of deaths occasioned by it cannot now be determined. About 90 cases fell under the observation of the parochial medical officers, of which number half proved fatal. To these would have to be added the deaths occurring in private practice. On the authority of Messrs. Braine and French, who at that time had medical charge of the Cholera Hospital, it may be stated that among the localities attacked were Peter Street, Hopkins Street, Maidenhead Passage, Pulteney Court, Berwick Street, Wardour Street, Broad Street and Carnaby Street, together with the courts and yards leading out of Great Windmill Street, the neighbourhood of St. James's Market, and also Angel Court and Crown Court, Pall Mall. At this period the general sanitary condition of the parish was doubtless defective; for attention was not then so strongly directed to questions concerning the public health. At the commencement of 1848, the Committee of Health and Sanitary Im-

provement detected and exposed, by their house to house visitation, numerous deficiencies in local cleanliness, especially in the public sewerage. In consequence of these inquiries a decided amelioration of such defects was accomplished; and it was a subject of congratulation amongst those who were interested in the health of the parish, that the epidemic of 1848-9, which so speedily followed, was even less severely felt by the inhabitants than the visitation of 1832.

1848-9. During the autumn of 1848 only three deaths from Cholera occurred in St. James's, viz. one each in Berwick Street, Poland Street, and Rupert Street. In the first four months of 1849 no fatal case occurred in the parish, although, from the middle of January to the middle of February, the effects of Cholera were plainly manifested all over London. On the 26th of May, one fatal case happened in Golden Square. In July, five deaths were registered, and the disease, continuing through August and September, proved fatal altogether to 56 persons, viz. 19 belonging to Berwick Street district, 19 to Golden Square district, and 18 to St. James's Square district. Seventeen additional deaths were registered from Diarrhœa. Thus the mortality from Cholera in the whole parish in 58 weeks of 1848-9 was about 15 in 10,000 persons living, whilst the corresponding rate in all London was 75, and in the immediately surrounding districts about 46. In St. Anne's, Soho, the relative mor-

tality was 30 to 10,000 persons living; and of 48 deaths which occurred in that parish, to a population of 16,480, only five took place in St. Anne's Court, then containing about 500 inhabitants. This visitation of 1848-9 commenced about the same period in St. James's as in the adjoining parishes, shewing itself earliest in the Golden Square district, next in the Berwick Street, and last in that of St. James's Square, but reaching its height in all three about the same period, and causing its greatest mortality in the weeks ending the 1st and 8th of September, corresponding in this respect with the general result throughout the metropolis.

The streets which suffered most were the following:—In the Berwick Street district, Peter Street (four deaths), Archer Street (two), and Pulteney Place (two); in the Golden Square district, the Workhouse (five inmates), Regent Street (two), South Row (two), and Little Windmill Street (two); in the St. James's Square district, Angel Court (six), Jermyn Street (three), Little St. James's Street (two), Great Windmill Street (two), and Queen's Head Court (two). The rest of the mortality consisted of single deaths in various streets. No fatal case occurred in Broad Street in 1848-9, although a man died of Diarrhœa at No. 6.

1850. Four fatal cases of Cholera are recorded during this year in the following localities:—Silver Street, Carnaby Street, Marshall Street, and Oxford Street.

1851. In this year one case is registered in Rupert Street.

1852. A single death is returned at 5, Marshall Street.

1853. During the last four months of 1853, when Cholera for the third time invaded the metropolis, ultimately to become epidemic, several fatal attacks occurred in St. James's parish, as follows:— In August, one case occurred in Great Windmill Street, and another in Bentinck Street. The next death, on October 2nd, was in Poland Street. After a short interval, five cases followed in one week, viz. three in the Workhouse on October 26th and 30th, and November 1st; two in Marlborough Court, October 30th; one in King Street, on the 31st October; and one in Great Marlborough Street on the 1st November. On the 4th November another fatal attack happened in the Workhouse; and the last death for the year 1853 was in Blenheim Street, on November 15th.

It is important to remember these successive visitations of Cholera in St. James's parish, and especially the presence of the disease during the autumn of 1853; for they serve to establish its liability to the inroads of that epidemic, although they entirely failed to prepare its inhabitants for the impending calamity of 1854.

1854. At the commencement of this year, there were but five deaths from Cholera registered throughout the whole of the metropolis during

the month of January; in February, only two, the last being on February 4th. For the eight succeeding weeks no fatal case was registered in London. During the month of April four deaths occurred. Three weeks passed without a death from Cholera, and then four happened in the latter part of May. In the first three weeks of June three deaths occurred, in the fourth week no death. In the first week of July one death was registered, in the second week 5 deaths, in the third 26, in the fourth 133, in the fifth 399; and so the numbers kept increasing weekly up to 2,050 in the week ending September 9th, and then diminished again, as shewn in the subjoined table. The mortality from Cholera, in all London, was reduced to 8 in the week terminating the 8th of November.

Now, according to the Registrar-General's returns, no death from Cholera took place during last year in St. James's parish until the week ending the 5th August, when one fatal case was returned. From this date the Cholera mortality in the parish rose and fell as shewn in the annexed table, in which the corresponding mortality in all London, and that in London exclusive of St. James's, is also shewn.

	July 29.	Aug. 5.	Aug. 12.	Aug. 19.	Aug. 26.	Sep. 2.	Sep. 9.	Sep. 16.	Sep. 23.	Sep. 30.	Oct. 7.	Oct. 14.
London	133	399	644	729	847	1287	2050	1549	1284	754	411	249
London, excluding St. James's	133	398	639	717	841	1209	1763	1482	1265	747	410	249
St. James's . . .	0	1	5	12	6	78	287	67	19	7	1	0

Adding to this list one more death which was recorded in the St. James's Square district in the week ending October 21st, the total number of deaths from Cholera registered in St. James's, in the 17 weeks ending November 4th, was 484. But this number gives a very inadequate idea of the entire loss inflicted by the epidemic. Thus the House List of deaths by Cholera, furnished to the committee by Mr. Buzzard, the vestry clerk, from the local registers, gives a total of 501 deaths recorded between July 1st and September 30th. Besides these, it is estimated that about 150 of the inhabitants died during the same period in the Middlesex, University College, Royal Free, St. George's, and King's College Hospitals, out of the parish, whose deaths would therefore be registered elsewhere. It would appear, indeed, from the investigations of Messrs. Fraser, Hughes, Ludlow and Whitehead, that some deaths must have escaped registration altogether, and that possibly more than 40 non-resident persons, who came to work or visit in the parish, also died. Hence the fatal attacks in St. James's parish were probably not less than 700.

So great a number would imply a relative mortality, during the above defined 17 weeks, of 220 to every 10,000 persons living in the parish, instead of 152 as estimated upon the data furnished to the Registrar's Office. The highest relative mortality in any metropolitan parish not containing a hospital,

during the same period, was in Bermondsey, viz. 158. St. Olave's alone, which includes St. Thomas's Hospital, exceeded it, its ratio being 162. In the adjoining sub-district of Hanover Square, the ratio was 9; in All-Souls, Marylebone (including a hospital), 28; in St. Anne's, Soho, 37; and in the Charing Cross district of St. Martin's-in-the-Fields (including a hospital) 33. It should also be borne in mind that the mortality from Cholera in St. James's parish in 1848-9 was, as already stated, only 15 in 10,000 inhabitants.

It is well known, however, that the epidemic did not act equally within all parts of the parish; the St. James's Square sub-district experiencing, according to the Registrar, a relative mortality of only 16 to every 10,000 persons living, whilst the ratio in the Berwick Street district was 212, and in the Golden Square district 217.

But, as before stated, the actual rate beyond the registration returns, in the two last named districts, was considerably greater than this. Moreover, it must now be remembered that it was only in a certain singularly well defined portion of them that the influence of the *great* outbreak was felt. The "*Cholera area*," as it may be called, of St. James's parish, may be variously described. Reference to the map prefixed to this Report will render the description easily understood. Spreading out from the north-east angle of Golden Square, which is altogether excluded from it, it extends

westward to King Street, north as far as Great Marlborough Street and Noel Street, east to the line of Wardour Street, and south to Little Pulteney Street, from the west end of which its limits are expressed by a line crossing over Great Pulteney Street and Bridle Lane, returning to the north-east angle of Golden Square. Beyond Wardour Street, to the east, lies St. Anne's Court, Soho, with its dependencies, which, though out of St. James's parish, must be included in the Cholera area. It has been shewn by Mr. Whitehead that the limits of the Cholera district are also very accurately defined within an irregular four-sided figure, the north and south angles of which are placed respectively near the middle of Poland Street and at the south end of Little Windmill Street, whilst the west and east points are at the north-west corner of King Street and the east end of St. Anne's Court. The included space is rather longer from east to west than from north to south. The centre of this figure falls at the junction of Cambridge Street with Broad Street, and it has been remarked by Mr. Whitehead, as may be shewn with compasses upon the map, that a circle, having a radius of 210 yards, struck from the north-west angle of Cambridge Street includes almost the entire area, except St. Anne's Court. Two notches vacant of mortality require, however, to be taken out of this circle; one corresponding with a part of Great Marlborough Street, the other with one half of Golden Square and the southern part of Bridle Lane. As

thus defined, and henceforth in this Report intended to be understood, the "Cholera area," including St. Anne's Court, and excluding the vacant spaces just mentioned, covers nearly 30 acres of ground, containing, besides streets, courts, and mews, 825 dwellings, St. Luke's Church, Craven Chapel, the Workhouse, a block of model lodging houses (unfinished in 1854), a brewery, and various factories and workshops. In round numbers, its population, in the autumn of 1854, as well as can be estimated, was nearly 14,000 inhabitants (inclusive of 500 in the Workhouse). This would be about 460 persons to an acre. Now the ascertained deaths of residents within this 'Cholera area' are 618, being at the rate of 440 to 10,000 persons living. The deaths of non-residents, so far as these are known, viz., 45, are also indicated on the map.

The ascertained deaths and per centage of mortality in the several streets within the Cholera area are tabulated in the Appendix, whilst the distribution of the deaths is represented in the map. No street in the Cholera area was without death, but the mortality was greatest towards the centre of the area, and diminished towards its borders. There are exceptions, depending mostly on an extreme mortality in some one house in a small street, as in Cross Street on the west, Bentinck Street on the north, and Peter Street on the south-east. In Hopkins Street, then containing only three houses, the mortality was 18 per cent. In

Broad Street, the very heart of the area, the deaths were rather more than 10 per cent., or 1,000 to every 10,000 persons living. In Cambridge Street, Pulteney Court, and Kemp's Court, the population was also decimated. In Marshall Street, South Row, Marlborough Row, Silver Street, Great Pulteney Street, Little Windmill Street, the southern portions of Wardour, Berwick and Poland Streets, the mortality diminished, varying from 8 to 5 per cent.; and, taking a still wider sweep from the centre, in the remoter parts of all these longer streets, as a rule, it gradually ceased. It will also be seen, on consulting the map, that in the centre of the Cholera area but few houses escaped the invasion of the disease. Of 45 contiguous houses belonging to Pulteney Court, New Street, Husband Street, Hopkins Street, and the south side of Broad Street, only seven escaped without a death; and in 3 of these seven, one a factory, 18 non-residents were fatally seized. In Broad Street, containing 49 houses, only 12 houses escaped without a death.

So also the proportion of houses fatally attacked, just as we have seen in regard to the per centage of deaths, became less in passing from the centre of the Cholera area. In the whole area, including houses where non-residents were seized, this proportion was 38·8 per cent.

Of the 825 houses in this area, fatal attacks of residents occurred in 313. There were 159 houses having single deaths; 85 with 2 deaths; 34 with 3; 15 with 4; 12 with 5; 3 with 6; 4 with 8;

and 1 with 12. Five inmates also died in the Workhouse. "There were," says Mr. Whitehead, speaking of only a part of the area, "no less than "21 instances of husband and wife dying within "a few days of each other. In one case, besides "both parents, 4 children also died. In another "both parents, and 3 of their 4 children. In "another a widow and 3 of her 4 children. At "an average distance of 15 yards from St. Luke's "Church stand 4 houses which collectively lost 33 "persons."

Such being the locality of this serious visitation, and such its general results, we may in the next place attempt to trace, within the limits of the Parish, its commencement, progress and cessation, from day to day, and from place to place. For this purpose, it is obvious that, owing to the variable duration of the illness, the death statistics would lead to erroneous conclusions; and it is much to be regretted that no complete data can be obtained for fixing the hour of attack. By deducting the period assigned to the duration of the disease from the day of death, where such information is recorded either in the registrar's or hospital documents, a rude approximation to the period of attack may be obtained. In regard especially to Cholera, this method may give tolerably fair results; but when we remember the difficulty of obtaining correct information and the importance of a few hours more or less, too great reliance must not be placed upon such results, nor too great use be

made of them, as the foundation of particular views. In the Table placed in the Appendix, 576 fatal cases in St. James's and St. Anne's are arranged to shew the streets in which they took place and the days on which the deceased are presumed to have been attacked. This tabular view of daily attacks is of course incomplete, and would differ widely from one of daily deaths. It is confessedly a partial view or an imperfect journal of the progress of the epidemic; but in its general aspect it may approach the truth. For convenience of reference, the streets are classified in four zones, or belts, running east and west across the parish, beginning with the northern zone from west to east, and then proceeding with the next one to the south, and so on. Only the two middle zones pass through the Cholera area.

The earlier deaths from Cholera in the metropolis last summer were scattered very widely about, in the extreme south, east, west and north,—the central districts escaping for a brief period. The first fatal attack in St. James's parish occurred on July 26th, in St. James's Market, Jermyn Street. It terminated fatally on the 29th, by which date 81 deaths had been registered in the south, 48 in the east, 11 in the west, 11 in the north, and 13 in the central metropolitan districts. It may therefore be said that the Cholera in the summer of 1854, as well as of 1849, shewed itself in this parish later than in most parts of the metropolis; and in reference to the immediately adjoining districts it must be added, that

St. Martin's-in-the-Fields, St. Anne's Soho, and All-Souls Marylebone, were attacked before, and St. George's Hanover Square after, St. James's.

Referring now to the Table, it will be seen that shortly after the first case already spoken of as happening on July 26th in the south of the parish, viz. in St. James's Market, two fatal attacks occurred in the west and centre, viz. in South Row on the 3rd August, and in Silver Street on the 5th. By the time these three attacks had occurred many more deaths had been recorded in the various districts of the metropolis, as follows:—south districts 371, east 108, west 33, north 23, and central 27. The fourth fatal seizure in St. James's was on the 7th, in the south, in Great Windmill Street; the fifth and sixth, both on the 11th, were in the west, viz. in King Street and Marlborough Row. On the following day, three persons were fatally attacked, two in the south and south-east of the parish, viz. in Piccadilly and Great Windmill Street, and one in the very centre of the district to be presently rendered so memorable, viz. in Broad Street, at No. 31. On the 14th, one seizure occurred in the west, in Heddon Court; and on the same day two near the centre, viz. in Silver Street and Marshall Street. On the 16th, two persons were attacked in Berwick Street, and one in Swallow Street; on the 17th, one in Marlborough Street; on the 18th and 19th, two persons in Marshall Street; on the 18th a man in Piccadilly, and on the 19th a man in Berwick Street. The deaths in Marshall Street were

in one house (the first being introduced from the Borough), and two of those in Berwick Street were also in one dwelling. During this week Diarrhœa was very prevalent all through the Berwick Street district and the adjacent part of the Golden Square district; but in the eleven following days, until the 30th August, Diarrhœa had disappeared, and very few fatal attacks of Cholera occurred; these were either in the south or west, but chiefly towards the centre of the yet future Cholera area, viz. in Carnaby Street, Silver Street, Marshall Street and Broad Street. It appears, therefore, that the disease manifested its fatal effects first on the south-east, west, and east quarters, and afterwards towards the centre of the Cholera area. Up to this date (August 30th) 38 cases only had occurred throughout the entire parish: but in the afternoon of the 31st August, 31 fatal attacks can be traced. On the 1st September, 131, and on the 2nd, 125. On the 3rd, 4th, and 5th, the numbers are respectively 58, 52, and 26; and on the 6th, 7th, and 8th, 28, 22, and 14. After that attacks occurred as follows, 6, 2, 3, 1, 3, 0, 1, 3, 4; and subsequently throughout the rest of September either 1, 2, or 0 per diem. In Dr. Snow's report, the number of daily attacks is also fully and carefully reckoned, as his inquiry took place immediately after the eruption of the disease.

We have here a record of what has so forcibly struck the attention of those who have studied this

memorable eruption of Cholera, viz. the ordinary gradual approach of the disease accompanied by no unusual manifestation of its effects, a lingering about certain localities, a lull in its operation, and then, on a sudden, a terrible outburst, overwhelming every one by surprise, outstripping the most prompt and energetic attempts to mitigate its effects, and then quickly declining by well marked though not quite such speedy steps.

It is this startling suddenness of the outbreak that has given it a scientific interest, scarcely less momentous than its social importance; and as few of us probably will ever witness its like again, it is most desirable that no pains should be spared in its thorough investigation.

On consulting the Table in the Appendix, in which the distribution of a great majority of the attacks in the several streets is indicated day by day, it will be seen that the suddenness of the principal outburst, as also its rapid subsidence, is chiefly marked in those streets and courts which are nearest to the centre of the Cholera area; whilst in the borders of this space, and beyond its limits, there is no such abrupt and extreme rise and fall in the number of the attacks. In Broad Street especially its commencement was sudden and its duration short; but the disease continued somewhat later to attack a few persons in other localities.

On the whole, however, the great explosion was almost simultaneous throughout the district; and

even in the remotest streets, it must be remarked that, though the attacks were few, the period of greatest activity corresponded with that of the principal outburst, and indeed with that of the highest Cholera mortality throughout the rest of London (see Table, p. 14). There was, moreover, a small simultaneous outburst in Rotherhithe.

There yet remain several characteristics of this visitation, which may here be noticed, as tending either to associate it with or distinguish it from other less severe and sudden outbreaks of the disease.

In the first place it may be remarked, that in 1854, though the epidemic visited the same streets as in 1832 and 1848–9, it did not limit itself so precisely to its old localities as is often observed. A coincidence in the localities affected is perhaps more marked in regard to the straggling cases on the outskirts of and beyond the Cholera area than in the heart of that district. We are informed by Dr. Fraser that in the whole parish identical houses were visited in only 11 instances, out of about a total, as we estimate, of 350 in which fatal attacks occurred. On the contrary, entire streets in the centre of the affected area, as Broad Street, Silver Street, Cambridge Street, Pulteney Court and New Street, in which no deaths from Cholera occurred in 1848–9, suffered the most severely in 1854.

Certain apparent eccentricities or preferences of localization, such as are very common in Cholera visitations, displayed themselves here also. For

example, one side of a street would suffer more than the other. In streets running north and south, the dwelling-houses being about equal on the two sides, the east side sometimes suffered most; in streets running east and west, the south side was generally most affected. Cambridge Street and Little Windmill Street are exceptions to the former, and Silver Street to the latter statement. The order in which houses were attacked followed no definite rule.

Some narrow streets and courts suffered severely; others nearly or quite escaped, as Tyler's, Great Crown and Walker's Courts; whilst wide streets, as Broad Street itself, were heavily visited.

In St. Anne's Court, the middle houses suffered most; in some *culs de sac*, as Bentinck Street and Peter Street, those near the dead end.

The south-eastern half of the Cholera area is a few feet lower than the north-western half; but the mortality was not attached to any particular level.

A want of cleanliness in streets or houses was by no means a constant accompaniment of the disease. Some houses in the midst of others affected escaped, without any favourable sanitary condition. The map shews that, of houses in the Cholera area directly opposite untrapped sewer-grates, 40·2 per cent. had fatal attacks in them, thus barely exceeding the general percentage throughout the area, viz., 38·8. Of two adjacent and equally well ordered factories, one lost seven workmen, the other none. Of nearly 200 workmen and women employed in another large factory, none living in the neighbourhood, the

females numbering about 160, the males about 30, sixteen of the former and two of the latter were fatally seized, whilst in the Workhouse, not 150 yards away, which had at the same time about 500 residents, only five inmates died. Of 35 men working in the open air on the unfinished lodging-houses, seven died.

Corner houses sometimes escaped, the 6 for instance on the north side of Broad Street, in one of which however there were 3 severe though not fatal attacks. Of corner houses in the Cholera area, about 30 per cent. had fatal attacks in them. Public-houses, so often situated at the corners of streets, were singularly lightly visited.

As a general condition, remoteness from the centre of the Cholera area seems most to have been associated with exceptional suffering, and proximity to it by exceptional immunity, from the disease.

Towards the centre of the area, in Broad Street, the number of deaths appears to have been nearly equal on each floor, if we reckon the ground floors and kitchens together. In reference to the population, however, the ground floors suffered most; next, in diminishing proportion, the first floors, third floors and kitchens, and least of all the second floors. Yet throughout the neighbourhood generally, including Broad Street, the deaths on the second floors were the most numerous of all. In the streets furthest removed north and south from the centre, the residents in the upper floors suffered somewhat more in proportion.

A calculation embracing the principal streets and courts shews that the number of deaths was rather greater in the front than in the back rooms of the houses.

The attacks in any given house were seldom quite simultaneous, commonly in quick succession, and more rarely at long intervals.

Tolerably true on the whole was this singular malady to its ordinary characteristics in the selection of its victims, whether we regard their occupations, general condition in life, sex, or age.

Of 636 registered deaths belonging to the parish, 298 were of males, and 338 of females, which is rather more females in proportion than usual. The ages of these deceased persons (with the exception of 6 unknown) were as follows:—

Ages . .	0—10.	10—20.	20—30.	30—40.	40—50.	50—60.	60—70.	70—80.	80—90.	0—90.
Males .	79	32	48	50	47	16	19	4	2	297
Females	56	33	40	51	61	51	30	10	1	333
Total .	135	65	88	101	108	67	49	14	3	630

It appears therefore that, as usual with Cholera, the smallest number of deaths happened in the second decade of life. The fewest deaths in any one year of age (viz. two,) were between 14 and 15. The inmates dying in the Workhouse, were aged persons.

The occupations of 454 persons dying (247 male and 207 female) are indicated in the subjoined Table, constructed from the Registrar-General's returns.

Occupations.	Males.		Females.		Total.
	Adults.	Sons.	Spinsters, Wives, Widows.	Daughters.	
Postmaster (retired),	1	..	..	..	1
Government Clerk,	1	..	..	..	1
Police,	2	..	..	1	3
Fireman,	..	..	..	1	1
Chelsea Pensioner,	1	..	..	..	1
Solicitor,	..	1	1	..	2
Surgeon,	1	..	..	..	1
Dentist,	1	..	..	..	1
Druggist,	..	1	..	..	1
Artist,	1	..	1	..	2
Schoolmaster,	..	..	1	..	1
Governess,	..	..	1	..	1
Lodging House Keeper,	..	..	2	..	2
Eating and Coffee House Keeper,	1	..	..	1	2
Domestic Servants,	2	..	28	2	32
Coachmen,	1	1	1	1	4
Charwomen,	..	1	4	..	5
Nurse,	..	..	1	..	1
Laundress,	..	..	1	..	1
Hairdresser,	1	1	2	1	5
Hatter,	1	..	..	..	1
Tailor,	40	12	17	9	78
Shoemaker,	28	8	8	3	47
Undertaker,	1	1	1	..	3
Dressmakers, including Staymakers and Waistcoat Makers,	..	..	15	..	15
Straw Hat Maker,	..	..	1	..	1
Commercial Traveller,	..	..	1	..	1
Pawnbroker,	2	..	..	..	2
Marine Store Dealer,	..	..	1	..	1
Livery Stable Keeper,	2	..	..	..	2
Carman,	2	..	1	..	3
Warehouseman,	..	1	..	..	1
Shopman and Shopwoman,	1	..	1	..	2
Messengers and Porters,	15	6	2	5	28
Errand Boy,	..	1	..	..	1
Printer,	2	1	..	..	3
Compositor,	1	..	..	..	1
Bookbinder,	2	..	..	..	2
Stationer,	2	..	..	..	2
Piano-forte Maker,	3	1	..	1	5
Picture Dealer,	..	..	1	..	1
Engravers and Chasers,	4	..	1	..	5
Artificial Flower Makers,	..	..	2	..	2
Feather Manufacturers,	..	..	1	2	3
Dyer,	..	..	..	1	1
Draper,	..	..	1	..	1
Mattress Maker,	..	..	1	2	3
Brush Maker,	..	..	1	..	1
Carried forward,	119	36	99	30	284

Occupations.	Males.		Females.		Total.
	Adults.	Sons.	Spinsters, Wives, Widows.	Daughters.	
Brought forward, . . .	119	36	99	30	284
Carpet Planner, ...	1	..	..	..	1
Coach Trimmers, ...	2	..	..	..	2
Engineer, ...	1	..	1	1	3
Carpenter, ...	4	2	5	2	13
Painter and Plumber, ...	8	1	2	..	11
French Polisher, ...	..	..	3	1	4
Timber Seller, ...	..	1	..	..	1
Cabinet Maker, ...	4	..	3	2	9
Upholsterer, ...	2	..	..	1	3
Japanner, ...	..	..	2	..	2
Curiosity Dealer, ...	..	..	..	1	1
Toy Maker, ...	1	..	..	..	1
Box and Gun Case Maker, . . .	3	..	1	..	4
Wine Cooper, ...	..	..	1	..	1
Frame Maker, ...	..	..	1	..	1
Basket Maker, ...	1	..	..	..	1
Glass Cutter, ...	..	..	..	1	1
Jeweller, ...	..	3	..	2	5
Gold Beater, ...	1	..	..	..	1
Gilder, ...	..	..	..	1	1
Smiths,—Copper, Tin, Iron, Gun, Brass,	3	5	2	3	13
Steel Manufacturer, ...	..	..	1	..	1
Ironmonger, ...	..	..	3	..	3
Coal Vendor, ...	1	1	..	..	2
Seavenger, ...	1	..	..	..	1
Labourers general, including Bricklayers, Paviors, and Masons, . . .	8	5	16	6	35
Milkwoman, ...	..	..	1	..	1
Cheesemonger, ...	3	1	..	..	4
Butcher, ...	6	1	1	..	8
Fishmonger, ...	..	..	..	1	1
Greengrocer, ...	3	..	..	..	3
Baker, ...	5	1	2	2	10
Confectioner, ...	..	..	1	..	1
Publican, ...	1	..	1	..	2
Waiter at Public House, . . .	1	2	..	..	3
Wine Merchant, ...	1	..	..	..	1
Grocer, ...	..	..	2	..	2
Tobacconist, ...	..	..	1	..	1
Gentlemen, ...	6	..	1	..	7
Alms (Workhouse), ...	2	..	3	..	5
Totals, ...	188	59	153	54	454
Occupations not Registered, .	41	10	91	40	182
General Totals, . . .	229	69	244	94	636
	298 Males.		338 Females.		636 Total.

The total number of persons of any given occupation in the district is not known, so that the ratio of mortality in each must remain uncertain. A few general conclusions are evident. The families of taïlors shew the largest number of deaths; next to these, shoemakers; then labourers, including bricklayers, masons, and paviors; then domestic, especially female, servants; next messengers and porters; then dressmakers; next follow mechanics of various kinds, as carpenters, smiths, painters, cabinet makers, and so forth. Of persons dealing in articles of food, bakers suffered most, and then butchers; whilst the families of greengrocers, publicans and fishmongers suffered less. General trades and the professions are also represented. It is necessary to observe that tailors and their families undeniably form a very large proportion of the working population of this district. On the whole it would appear that the disease did not limit its attack to any one class, nor yet to the very poor.

It is remarked by Mr. Sibley, the Registrar of the Middlesex Hospital, that a large number of the persons brought there for treatment presented a very uncleanly appearance; more so, indeed, than patients admitted into hospitals for ordinary disease. This may doubtless be explained, partly by the circumstance that the patients so admitted were probably the most destitute of those who were attacked, and partly by the fact of their being sud-

denly seized by the disorder whilst engaged in the usual occupations of their trade.

Finally, in this extraordinary outbreak, the symptoms of the disease quite corresponded with those of Cholera generally. The common occurrence of the attack within the fore part of the twenty-four hours, the extremely short duration of the early cases and the gradual amelioration observable in the later ones, were all plainly noticeable; and lastly, it is certainly true that in the cases occurring at the commencement of the great outburst, premonitory Diarrhœa was of short duration, or altogether absent.

It will have been noticed that the preceding estimate of the results of the Cholera outbreak in St. James's parish is founded entirely on the death statistics. The number of attacks followed by recovery is unknown; nor can any certain information be collected as to the relative amount of Diarrhœa prevailing.

CIRCUMSTANCES ATTENDING THE OUTBREAK.

The sudden, severe, and concentrated character of the particular outburst of Cholera which has thus been depicted, and which constitutes the most

remarkable local visitation of that disease hitherto recorded in the metropolis, may at first create a hope that here at least the circumstances which principally determined the localisation of this singular epidemic would not escape a rigorous investigation. But the disadvantages attending a comparatively late inquiry, and the difficulties encountered in its prosecution were so great, that very decided conclusions must not be expected.

From our ignorance of the real or specific cause of Cholera, all inquiries like the present are practically limited to a consideration of those conditions which may determine the action of that cause upon and within certain localities. Further, it must be remembered, that in this comparatively restricted field of investigation, the want of knowledge just alluded to constitutes a grave difficulty. For if the cause of Cholera were itself as well understood as electricity, arsenic, prussic acid, or morphia, means could be found by which to determine its presence, qualities and quantity, and thus to lay bare, on positive evidence, the conditions which influenced its action, or cessation of action, in given places. But since we do not know the cause of Cholera, the questions to be solved concerning its appearance and disappearance, its spreading and concentration, can only receive provisional answers, approximating to the truth according as we have advanced, in the obscurity of our research, towards accuracy of observation,

correctness of deduction, and freedom from fallacy and error.

In attempting to analyse the circumstances which may be supposed to have had more or less influence in directing the terrible energies of this unknown cause towards a particular portion of the metropolis, we shall first examine the probable effect of those *general* conditions which must have operated in very much the same manner and degree in every part of it; such as the rainfall, the temperature and dryness and movement of the air. This will facilitate the subsequent examination of *special* or *local* conditions.

General or Meteorological Conditions.

It has been pointed out by the Registrar-General, speaking of the metropolis generally, that "in the thirty-sixth week of 1854, when Cholera "raged, and the deaths from all causes rose to their "maximum (3413), the average daily range of tem-"perature was 30°.9, considerably the greatest in the "fifty-two weeks; the highest temperature of the "week was 81°.2, the lowest was 43°.1, therefore "the entire range was 38°.1; the horizontal "movement of the air was only 195 miles, far "less than in any other week; there was no rain "in that or the previous week, and the mean "temperature of the previous week had risen to "65°.1, the highest mean weekly temperature in

" the year."—(*Summary of Births, Deaths, &c., in London, for fifteen years*, 1850–1854.)

This brief summary does not exhaust the interest attached to the general meteorological conditions prevailing in the metropolis during last summer and autumn, as especially applicable to our present inquiry.

Rain.—From the 6th August, when Cholera had fairly established itself in London, to the 11th September, when it had begun to decline,—*i.e.*, for a period of 37 days,—there were only 7 days on which rain fell; the total quantity during that time being under three-tenths of an inch, one-third of which, *i.e.*, one-tenth of an inch, fell in one day, the 15th August. From the 25th August to the 11th September (18 days), there was no rain at all, and it was within that period that Cholera manifested its greatest virulence.

Temperature of air.—From the middle to the end of July the temperature was excessive, and from thence to the end of September it was also decidedly above the average for that season of the year. Its maximum and mean daily value, and its daily range, stood very high on the 27th, 28th, 29th, and 30th of August, and on the 3rd, 4th, and 12th of September; the maximum temperature fluctuating from 80° to 85° in the shade, and from 99° to 111° in the sun; the three hottest days being the 27th, 28th, and 30th August. On the 31st August, and on the 2nd, 5th, 6th and 7th Sep-

tember, the temperature, though not so high, was from $\frac{1}{2}^{\circ}$ to 4° above the average calculated for 38 previous years. On the 1st September the temperature fell slightly, $\frac{6}{10}$ of a degree below the average for that day, still however reaching to 72° in the shade and 94° in the sun. On the 27th, 28th and 29th August, there was more or less cloud and haze; but from the 30th August to the 6th September the sky was almost continually cloudless.

Temperature of water in the Thames.—During the months of July and August the *mean* temperature of the water at Greenwich was 64°; in September 63°. In the two weeks ending September 2nd it ranged from 60° to 68°.

Hygrometric state of the air.—As tested by the dew point, the air was drier than usual in the months of August and September. Compared week by week, its mean dryness increased and diminished somewhat like the mortality from Cholera; but examined daily during the latter part of August and the beginning of September extreme variations are recorded at Greenwich on any one day; and from the 30th August to the 6th September the lower atmosphere was not far from complete saturation at some period of each twenty-four hours.

Wind.—On the 26th August the wind, which for four weeks had been from S.W., W., or S., changed to N.W. On the next three days there was only occasionally a very gentle movement from the N. On the 30th, what wind there was, was N., and

then S.W. and W.S.W. On the 31st S.W., and then N.E. On the 1st September, N. On the 2nd, S.E. and E. From the 3rd to the 12th September, N.E., and after that S.W. again.

Horizontal movement of the air.—The stillness of the air during the two weeks ending September 2nd and September 9th, in which the mortality from Cholera rose to its height, was very remarkable,—the total horizontal movement for those weeks being not more than 245 and 195 miles. Now, during the ten years from 1845 to 1854, the average weekly movement was 783 miles, and the average for the year 1854 itself 687. Instead however of 100 miles a-day, the average daily rate in the two Cholera weeks, as they might be called, was but little more than 30 miles. But even this is not an adequate account of the unusual stillness of the air; for during the 10 previous years, not 10 single weeks can be found in which the movement was less than 195 miles; and further, during the two weeks just indicated even the slight movement which did occur was not continuous, but interrupted by long intervals of calm. Thus, out of 16 days, from the 27th August to the 11th September, there were 11 days more or less calm; seven of these, viz. 27th, 28th and 29th August, and 1st, 4th, 10th and 11th of September, were calm throughout; and four, viz. 30th August, and 2nd, 7th, and 9th September, were calm during one half of the 24 hours.

Barometer.—Coinciding with this dry, hot, and quiet state of the atmosphere, the barometric range was continuously high, as would be expected.

Electricity and ozone.—The electricity, when observed, was positive and of moderate tension. The ozone action was defective or not manifested at all, a fact probably of serious import.

General conclusions.—From the preceding account it is plain that the period of greatest mortality from Cholera in the metropolis last autumn was characterised by a previous long-continued absence of rain, and by a high state of the temperature both of the air and of the Thames,—conditions which would render the waters of that river more concentrated as to impurity, favour periodical evaporation from its surface, and explain the alternating (diurnal and nocturnal?) extremes of dryness and saturation of the air. There was also an unusual stagnation of the lower strata of the atmosphere, highly favourable to its acquisition of impurity, to the operation of those partial currents which are caused by local variations of temperature, and to the more subtle movements dependent on the law of diffusion. Moreover, at the rise of the epidemic in London after the middle of July, it will also be found that somewhat similar conditions prevailed for many days; whilst at its decline they were all more or less changed; and although it is impossible to assert that the relations here pointed out were uniformly exact, or to fix the precise share which

each of the conditions enumerated might separately have in favouring the spread of Cholera, the whole history of that malady, as well as of the epidemic of 1854, and indeed of the plagues of past epochs, justifies the supposition that their combined operation, either by favouring a general impurity in the air, or in some other way, concurred in a decided manner during last summer and autumn to give temporary activity to the special cause of that disease.

If this supposition be correct, it is obvious that the same general meteorological conditions would operate simultaneously in the limited locality to which the present inquiry is directed; and here too we have found that the Cholera outbreak suddenly declared itself after the four hottest and calmest days of August, viz. the 27th, 28th, 29th and 30th. But, as previously shewn in the history of this local outbreak, the resulting mortality was so disproportioned to that in the rest of the metropolis, and more particularly to that in the immediately surrounding districts, that we must seek more narrowly and locally for some peculiar conditions which may help to explain this serious visitation.

Special or Local Conditions.

The considerations involved in this part of the inquiry may be discussed under the following heads:—Elevation of site; soil and subsoil; surface and ground plan; streets and courts; density of the

population; character of the population; internal economy of dwelling-houses, as regards light, ventilation, and general cleanliness; cesspools, closets, and house-drains; sewerage; and water supply.

Elevation of site.—As shewn in the Table at page 55, the mean elevation of St. James's parish above the Thames high water mark is 58 feet, whilst that of the Berwick Street and Golden Square districts respectively is 65 and 68 feet. The highest point in the parish, about 75 feet, is near the junction of South Row with Marshall Street, situated in the last named district. So far then from the unusual mortality from Cholera in those districts in 1854 being thus explained, it stands as the most remarkable exception to that very interesting general relation, which has been shewn by Mr. Farr to prevail throughout the metropolis, between lowness of level and a high mortality from Cholera.

According to the prevalent rule, the annual mortality from that disease in St. James's parish would not be above 40 in 10,000 persons living, whereas in seventeen weeks of 1854 it reached a registered ratio of 152; or even by taking the mean of the low rate of 1849 and the higher rate of 1854,—a proceeding which, though it serves to equalize the mortality numerically, in no way diminishes or explains the exceptional character of that of 1854,—the ratio is still 84 to the 10,000 living persons. Indeed, as is clearly shewn in the Table, the actual mortality was greatest in the

highest quarter of the parish, largely exceeding that of immediately adjacent districts which have a nearly corresponding elevation, and reducing the Cholera area of St. James's to a level with Bermondsey which has a mean elevation corresponding with the high water mark. (Compare the Table, p. 55.)

In the epidemic of 1849, similar exceptions to the general rule were instanced in St. Giles's (Holborn) and in Bethnal Green, but none of so extraordinary a character as that now under consideration; and, full allowance being made for the acknowledged irregularities in the local distribution of successive visitations of Cholera, this fact alone would suggest the existence of some special localizing condition.

Soil and subsoil.—Beneath the artificial or made soil of from 8 to 12 feet thick, which, as is usual in districts long covered with houses, is composed principally of accumulated rubbish charged with various *débris*, the natural subsoil of the entire parish is gravel, forming part of the gravel bed which extends in a westward direction through Hyde Park. Towards and at the bottom of the gravel, which varies from 20 to 30 feet in depth, are veins or layers of sand resting upon the London clay and abundantly charged with water.

This gravelly substratum insures a good natural drainage of the surface-soil and of the basements of houses, and is of course favourable to the salubrity of the district.

It should here be mentioned that the ancient

pest-field used by the neighbouring parishes, in the time of the Great Plague, had its locality east of Regent Street and north of Golden Square. As considerable doubt and error still prevail in regard to the site of this field, a slight digression may be permitted, in order to settle a subject both of medical and topographical interest*.

The history of this pest-field is associated with the name of William, the renowned Earl of Craven, the same who fought under Gustavus Adolphus, was married, it is said, to Elizabeth, daughter of James I. and Queen of Bohemia, and, having lived through troublous times, reluctantly surrendered, at the head of the Coldstream regiment, the protection of St. James's Palace to the Dutch Guards of the Prince of Orange. This remarkable man, who died in 1697, at the great age of 88, continued to reside at Craven House, Drury Lane, throughout the whole time of the plague in 1665-6. He first hired and then purchased a field on which pest-houses (said to be 36 in number) were built by him for persons afflicted with that disease, and in which a common burial ground was made for thousands who died of it. In 1687 the Earl gave this field and its houses in trust for the poor of St. Clement's Danes, St. Martin's-in-the-Fields, St. James's West-

* The acknowledgments of the Committee are due to Mr. Wickens, solicitor to the Craven estate, to Mr. Goodwyn, to Mr. Crace, and to Mr. Farrant, for their assistance in regard to this matter.

minster, and St. Paul's Covent Garden, to be used only in case of the plague re-appearing; and the place came to be known as the Earl of Craven's Pest-field, the Pest-field, the Pest-house-field or Craven-field. In 1734, the surrounding district having become covered with houses and streets, a private Act, 7th George II., c. 11, discharged this pest-house-field from its charitable trusts, transferring them without alteration to other land and messuages at and near Byard's Watering Place, (Bayswater) Paddington, now called Craven Hill. This Act refers to the original conveyance for a description of the abutments and boundaries of the field, states that it contains three acres, more or less, and mentions, as belonging to it, "one way "or passage of sixteene ffoot wide.....to and from "the premises by the Slaughter-house there lead-"ing into Eyre Street."

The original extent of the Craven Estate, so far as it corresponded with the site of the pest-field, is correctly shewn in the map prefixed to this report. Some additional property lying between West Street and Carnaby Street, purchased by Lord Craven in 1774, has nothing whatever to do with the ancient pest-field. Moreover a small portion of the north-east part of the field itself no longer belongs to the estate, having been first rented and subsequently purchased by St. James's parish as a burial ground. The present Public Baths and Wash-houses are built over the greater part of this portion. The width

of the pest-field, from the middle line of Marlborough Row and West Street to the west side of Dufour's Place, is about four chains; its length from the top of Brown's Court, at the back of the premises in part of Great Marlborough Street, to the set-off against No. 4, Marshall Street, is rather less than eight chains; so that, including the part sold to the parish, it contains three acres and a fraction, forming a tolerably exact parallelogram twice as long as it is wide. The short narrow piece of Marshall Street, next to Silver Street, (although now 18 feet wide,) undoubtedly corresponds with the way or passage mentioned in the Act, for in what appears to be the original trust deed now existing in the Craven office, this way is described as excepted out of the premises abutting the pest-field on the south, and the "Eyre Street" mentioned was probably an extension of Air Street running northwards to join Silver Street near the point in question, before Golden Square was built. In an early and perhaps unique impression of Blome's Map of St. James's parish (one of the series to illustrate Strype's edition of Stowe) which is now in the possession of Mr. Crace, the pest-field is shewn with a passage leading to it on the south from Silver Street, Golden Square being also laid down. The date of this map is probably 1680-90. The field itself is represented as if covered with grass, excepting a roadway which extends from the entrance-passage nearly to its northern boundary. On the east of

this roadway, about two-thirds of the distance up, the pest-houses are shewn, probably in a conventional manner, as a single block of buildings. In a later impression of this map, printed in 1720, the houses, grass and roadway are all scraped out.

From this description and the plan it will be seen that at the present moment nearly the whole of Marshall Street, South Row and a part of Broad Street, traverse the old pest-field; whilst West Street and Marlborough Row occupy a strip of its western edge. Considerable doubt exists as to the precise part or parts of the field in which the burial pit or pits were dug. In quite recent times evidences have been met with in two spots, one the site of Craven Chapel, the other in the right hand lower corner of the former field, which would seem to indicate at least two places of burial. The latter position corresponds with Maitland's statement that "at the lower end of Marshall Street, con- "tiguous to Silver Street, was a common ceme- "tery, in which thousands of corpses were buried "in the time of the plague;" whilst Craven Chapel stands on part of the open ground of the old Carnaby Market, a space which for some reason was long unoccupied by any building, though houses had been built on other portions of the field, and which open ground was styled the Pest-field up to the time of Craven Chapel being built.

It has been often alleged that in some way or other the remains of decomposing animal matter,

or indeed of the plague matter itself, lying in the soil of this district, are chargeable with the great mortality from Cholera near it. Popular opinion has even gone so far as to maintain that the disease of last autumn was not Cholera, but a direful kind of black fever. But it is scarcely conceivable that any specific poisonous agent should remain undecomposed in the ground for 200 years; and it is improbable that animal matters, generally, enclosed for so long a period in a gravelly soil should retain noxious qualities of any kind. Yet the possibility of this latter contingency cannot be absolutely denied. Supposing it to be so, such substances could only act by tainting the air directly, in consequence of the disturbance of the soil, or indirectly through the leakage of gases or fluids into the sewers; or they might otherwise act by contaminating the well-waters of the neighbourhood.

Deep cuttings made in laying down new sewers were carried through one part of the old pest-field in 1851 (as shewn by the blue colour), and through other parts (as indicated by pink colour) in the winter of 1853-4, the last-named works being completed in February 1854; but no evidence exists of either line having passed directly through an ancient plague-pit; no serious nuisance occurred at the time the ground was opened; and no immediate ill consequences ensued to the health of the surrounding inhabitants. It is well known that the whole of the pest-field was not used as a burial place; and, as

it happened, the cuttings for the new sewers passed through a fine gravelly soil. Moreover, an interval of at least seven months occurred between the period at which the earth was broken up and the outbreak of Cholera which was imagined to have been thus produced; and, it may be added, the site of the pest-field comprises but a small part of the "Cholera area," and was not more severely visited than other quite distant parts of it.

In reference to the opinion that the sewers themselves may have become channels of contamination by the passage into them of gases or fluids from the pest-field soil, it must be remarked that percolation of any kind would be very unlikely through sewers so newly constructed; at all events, this would have taken place much more easily through the older and more decayed ones, and yet in 1832 and 1849, although Cholera penetrated the district, no unusual outburst took place; moreover, as will be subsequently explained, the drainage from the pest-field flows in two definite directions, whilst the aggravated effects of Cholera were equally felt along other lines of sewers.

As regards the possible contamination of the well water by the fluids of the pest-field, it must be remembered that, in the numerous excavations which have been made in its soil from time to time for the foundations of houses, in sinking wells, and in cuttings for sewers, drains, gas and water pipes, not only must much of the actual plague deposit

have been removed, but the soil has been so perforated and channeled that for many generations past, in addition to the natural drainage which is very perfect, it has been draining itself continually in these artificial ways and so ridding itself of its noxious contents. Hence the chances of the contamination of the well water by the pest-field fluids would become less and less every year, and would certainly be greater in 1832 and 1849 than in 1854. Even the older sewers have been known to rob the water supply from certain wells, and the new cuttings, being of greater depth, must act still more efficiently to relieve the soil of any impure fluids with which it may be charged.

On the whole, the supposition of the injurious influence of the pest-field as a special cause of the Cholera outbreak in St. James's, is not supported by any important facts.

Surface and Ground Plan.—With the exception of St. James's and Golden Squares, Burlington Gardens, part of the Church Yard and the Workhouse Green, every spot in St. James's Parish is either covered by buildings or more or less perfectly paved; and it is hardly necessary to add that there are no open ditches, ponds or stagnant waters, and no pieces of habitually damp ground. The surface is least occupied by houses in the St. James's Square district; more so in the Golden Square; most of all in the Berwick Street district.

Streets and Courts.—In the St. James's Square

and Golden Square districts there are many long, direct and wide streets, but in the Berwick Street and contiguous parts of the Golden Square district most of the streets and courts are comparatively narrow, short and exceedingly intricate in their arrangement. Some of the streets even have a dead wall across one end; whilst, of the greater number of those which have a thoroughfare both ways, the junctions with each other are at such irregular intervals that they appear to be obstructed, the view either way is exceedingly limited, and the neighbourhood is very perplexing to a stranger. Even so considerable a street as Broad Street presents no direct outlet at either end. Out-of-door ventilation along the streets is seriously impeded in such a neighbourhood. The heart of the district is much protected both on the east and on the west,—the quarters from which the prevalent winds of this country blow. In calm weather the stagnation of the street atmosphere must be almost complete. Indeed, during the hot still days at the end of last August, this was painfully felt and noted by many of the inhabitants. As a special instance, it may be mentioned that the persons residing in Pulteney Court and New Street complained of feeling suffocated by the temporary closing of Cock Court, during the erection of the model lodging houses named Ingestre Buildings.

Lastly, it must be noted, as touching this question of out-of-door ventilation, that in the district now under consideration, the yards to the houses are

generally very small, and all available spaces behind the dwellings are covered with factories, workshops or small tenements or cottages,—all offering further impediments to a proper circulation of air outside the houses.

Density of Population.—From the close covering up of the surface which has just been described, it might be expected that this part of St. James's would be very densely peopled. The fact is so to a startling degree. The entire parish in 1851 had a population of 222 persons to an acre, standing in this respect within three of the top in the list of the 36 registration districts in the metropolis. The sub-district of St. James's Square had a density of 134 per acre; that of Golden Square 262; whilst the Berwick Street sub-district had a population of 432 persons to an acre, being actually the most densely crowded of the 135 sub-districts into which London and its suburbs are divided*. The removal of the block of houses between Hopkins' Street and New Street, for the erection of Ingestre Buildings, which were incomplete at the time of the Cholera outbreak, would somewhat reduce the population

* See Table, p. 55. We may here point out an accidental but important error in the Registrar-General's weekly returns, commencing September 30th, 1854, by which the respective areas of St. James's Square and Golden Square sub-districts,—85 and 54 acres,—are reversed. This has further vitiated the estimated population per acre in those sub-districts, in the table given in the weekly return for December 30th, p. 547, where the population is said to be 212 in St. James's Square, and 166 in Golden Square, instead of 134 and 262 respectively.

in the Berwick Street sub-district in 1854. The relatively smaller population in the Golden Square district is accounted for by its including Golden Square, the whole width of Regent Street, Great Marlboro' Street, the Earl of Aberdeen's, the Pantheon, and the Workhouse Yards; but there are parts of it contiguous to the Berwick Street sub-district, and comprised within the Cholera area, which are quite as densely crowded as the latter; and, since all parts are not equally overcrowded in either, the high rate of the population per acre implies a much greater concentration of the evil in special localities.

Character of the Population. — Confining our attention now to the district particularly affected by the Cholera, it may be stated, in general terms, that the great mass of the persons inhabiting the densely crowded parts is composed of the families of labourers, mechanics and journeymen (many of them tailors), of persons, in short, employed at fair wages and manifesting no peculiarity in moral characters, habits or occupation beyond those usual to their class*. The number of those who live other-

* It was found, in the epidemic of 1849, that through London generally there were fewer deaths from Cholera on Wednesdays, Thursdays, and Fridays, than on tho other days of the week,— the fewest of all being on Fridays. The highest mortality took place on Mondays and Tuesdays. This difference was attributed in part to the indulgences often practised at the beginning and end of each week. In St. James's, however, the greatest number of attacks was on Friday, and the daily range of mortality does not justify any general inference unfavourable to the habits of those who were

wise than by industry is certainly small. Besides the residents in this crowded district there is a daily influx and efflux of probably 2000 persons engaged within it in various workshops and factories in none of which however are any specially injurious processes carried on. The larger and less crowded streets are occupied by tradespeople and the professional classes, in every way corresponding with those of similar neighbourhoods.

Dwelling Houses,—internal economy as to space, light, ventilation, and general cleanliness.—For the most part the houses in this district are old, having been built about the years 1700 to 1740. As already stated, the yards are very small and much covered, but there are no houses built back to back. In some streets the houses are what are termed 3rd class houses, containing from 10 to 15 rooms. In the smaller streets they are 4th class houses. The rooms of course vary in size and height, and, as usual in dwellings constructed 150 years back, are not objectionable unless over-filled with inhabitants. Cellars and vaults are common; the front areas are narrow and much covered in. Of light there is, generally speaking, an abundance, as the numerous windows, constructed before the adoption of a Window Duty, have been re-opened since its abolition. The indoor ventilation is, on the whole, defective, the staircases and passages being

seized,—a conclusion entirely in accordance with their varied position in society, and also with the assertions of those who know the district.

narrow, and the sashes, with some exceptions, being single-hung, so as to open only at the bottom, a serious defect which cannot be too strongly condemned. Probably not more than a dozen houses in the affected district are occupied by a single family, the sub-division of one dwelling among many families being the rule. The competition for rooms has been so great that a respectable workman can often only afford to have one for his whole family. The underground rooms or kitchens are frequently inhabited; in Broad Street, for example, in nearly two out of five houses; in many of the smaller streets, half of the kitchens are occupied as dwelling and sleeping rooms, sometimes by a numerous family; but more commonly the number of persons in each kitchen is small. The ground floors of more than half the houses are occupied as shops. The population, taken generally throughout the district, is accumulated rather in the 1st, 2nd and 3rd floors, the 2nd floor being usually the most densely peopled. In Broad Street the average number of persons to a house is about 18, and to each floor $5\frac{1}{2}$. But the greatest differences prevail, for even in Broad street there are instances of 30 persons living in one house; in one of the smaller streets 54 persons were crowded into one dwelling. The unusual overcrowding of certain houses follows from the general statistics already detailed. In the "Cholera area" the ratio is between 17 and 18 persons to each house.

Now, in the close and complicated streets, in the

densely packed dwellings, in the climax of overcrowding as compared with all London, in the character and occupations of the people and in the general economy of the houses, conditions are found which, with other necessarily attendant evils, might be supposed to neutralize the advantages arising from the nature and elevation of the soil. Such an explanation indeed has already been offered by Dr. Baly in regard to the comparatively high rates of mortality from Cholera observed in Bethnal Green and in St. Giles' Holborn. Within very straitened limits and with unfavourable external conditions, there is certainly to be found in the Cholera area of St. James's a large number of that very class of persons,—labourers, mechanics, artisans, journeymen, and tradespeople,—who usually supply the most victims to the disease. But that this circumstance, combined even with defective domestic arrangements, is adequate to explain the actual outbreak, appears doubtful; or why was not the presence of the Cholera agent in this same district in 1832 and 1849, although then equally overcrowded, attended by the same lamentable consequences; and why did not Cholera, which was present at the same time, under the same meteorological conditions and with closely corresponding local circumstances, in the adjoining districts, ravage them to the same extent? In All Souls Marylebone, in St. Anne's Soho (excluding St. Anne's Court), in St. Giles's, and in parts of St. Martin's-in-the-Fields, nearly similar spots could be pointed out; yet, as

shewn by the annexed Table, the mortality in each was, compared with that of St. James's, very low.

Table shewing the Mortality from Cholera in various parts of the Metropolis, with the elevation, density of population, and general Mortality of the same:—

	Localities.	Hospital or Workhouse.	Deaths from Cholera to 10,000 Persons living. 1849.	Deaths from Cholera in 17 weeks to 10,000 Persons living. 1854.	Elevation, or Feet above Trinity High Water.	Persons per Acre. Census 1851.	Annual Deaths from all Causes to 10,000 Persons living. 1841—1850.
London, ...		..	60	45	39	30	246
Districts.	Bermondsey, . .	W.	161	158	0	70	268
	Holborn, . . .	W.	35	5	53	238	246
	St. James's, . .	W.	16	152*	58	222	206
Sub-District of	St. Giles, South, .	W.	97	32	64	317	363
Sub-Districts surrounding St. James's.	Mayfair, . . .	W.	15	23	56	95	181
	Hanover Square, .	..	4	9	64	45	163
	All Souls, (Marylebone)	H.	25	28*	76	258	290
	St. Anne's, Soho, .	..	27	37	64	327	203
	Charing Cross, in St. Martin's . .	H. W.	48	33	17	48	284
Sub-Districts, St. James's.	St. James's Square. .	..	13	16	40	134	133
	Berwick Street, . .	..	18	212*	65	432	224
	Golden Square . .	W.	16	217*	68	262	257
Cholera Area of St. James's, .		W.	17·5	440	66	460	(?)

* Corrected by transferring certain Deaths from All Souls, Marylebone, in which Middlesex Hospital is situated, to the localities in which the fatal attacks occurred.—(See Registrar-General's Returns).

In certain instances within the Cholera area the mortality bore a direct relation to the density of the population. This is true chiefly of streets in the centre of the district; for towards its borders an overcrowded people, with defective external and internal ventilation, and a large amount of general uncleanliness, did not suffer in the same degree, as in the lower part of Wardour Street, in Peter Street from No. 20 to 32, in Walker's Court and in Little Pulteney Street. Individual instances of extreme uncleanliness in both streets and houses, as No. 7 Husband Street, were sometimes associated with comparative immunity from the disease; whilst some of the wider streets and well-ordered and scantily filled residences were visited severely. It has already been mentioned that 7 workmen engaged in the open air, in the erection of Ingestre Buildings, died; at least 30 other non-residents, visitors or workmen, besides about a dozen others who merely came to dine at chop or coffee-houses in the district, also died; yet none of these persons slept in it, or could have been much influenced by its permanent conditions. Lastly, as bearing on this subject, it must be noted that the average annual mortality of the Berwick Street and Golden Square sub-districts from all causes of death, is by no means high (see previous Table), shewing that no serious results ordinarily ensue from the acknowledged sanitary defects just described. The elevation is probably the chief cause of this general healthiness.

Finding then that the evils necessarily attending

the most densely crowded population within the circle of metropolitan registration do not offer a clear and decided explanation of the aggravated results of Cholera in this parish, we pass to such other local sanitary disadvantages as might or might not accompany this overcrowding and so be obnoxious or otherwise to health, viz. the state of the cesspools, house-drains, sewers, and water supply.

Dust-bins and accumulations in yards, cellars and areas.—At the time of the visitors' inquiry very careless arrangements were still found to exist in regard to these points, and at the period of the Cholera visitation there were undoubtedly many nuisances of the kind; but on the best authority it may be stated that Cholera was most impartially distributed between the comparatively dirty and comparatively cleaner spots.

Cesspools, closets and house-drains.—The visitors' inquiry lists sufficiently prove the insuperable difficulty of arriving at true results as to the existence or absence of cesspools. There is every reason to believe that they exist in large numbers. Originally such receptacles would be sure to be provided, and, as an illustration of the abundance of these obnoxious pits in certain parts of the parish, it may be mentioned, on the authority of the late Sir H. de la Beche, that when Derby Court, Piccadilly, was pulled down to clear a site for the Museum of Economic Geology, no less than thirty-two cesspools had to be excavated.

Such cesspools are frequently situated in the

narrow front areas, kitchens or vaults, there being generally no space available for such conveniences in the back-yards. In the event of any obstruction or overflow the entire basement must therefore be filled with deleterious substances or gases. These cesspools are generally connected with the sewers by means of flat-bottomed brick drains, having, in some cases, the advantage of a bricklayer's water-trap in the area or vault. Of the faulty construction of these drains and traps, and of the defective state of repair and blocked-up condition of many of the cesspools, little doubt can exist after the discovery of all those defects in the inquiry conducted by Mr. York at No. 40 Broad Street. The house-drains themselves are also of considerable age and are probably in many cases in the decayed condition detected on the same premises.

Equally impossible is it to ascertain, without additional powers of search, the mode in which these house-drains are connected with the sewers; but it may safely be stated that for the most part it is by a simple outlet or drain-mouth, without other trapping than the water-trap in the area. Frequently, when the original sewers are replaced by new ones situated at a greater depth, this opening is made near the *top* of the sewer arch instead of towards the bottom. In some houses, but certainly in the minority, water-closets with pipe-drains and leaden air-tight flaps are substituted for the older arrangements.

Sewers.—Owing to successive alterations and ad-

ditions the sewerage of the district affected by the Cholera is arranged in a rather complicated manner. Its plan, as it existed in the autumn of 1854, is laid down in the map prefixed to this Report, constructed on the authority of the one published in Mr. Cooper's Report to the Metropolitan Commissioners of Sewers. The older sewers, some of which were built as late as 1823, are left uncoloured; a new sewer constructed in 1851 is shaded blue; whilst the late extensive additions made in the winter of 1853-4 are tinted pink. The several systems appear to work as follows :—

a. Waterflow. 1 —Starting from the high ground near the junction of South Row with Marshall Street there is a fall in the sewers in two directions, so that the drainage from the upper part of Marshall Street, South Row and all the intermediate courts and streets to Carnaby Street flows westward through Tyler Street and Foubert's Place into the Regent Street sewer. 2.—On the other hand, the middle third of Marshall Street, from South Row to Broad Street, Broad Street itself (including Dufour's Place) as far as Cambridge Street, Cambridge Street and the two Windmill Streets, form another line of flow, running south, east, and then south again. 3. The eastern half of Broad Street, Poland Street, Berwick Street and its dependencies, Pulteney Court, and all the small streets and courts east and south as far as Wardour Street and Little Pulteney Street, ultimately run into the Wardour Street

sewer. 4. The short piece of sewer in the lower part of Marshall Street, south of Broad Street, ends in a transverse line which follows Silver Street, and from a point opposite to Bridle Lane falls in two directions, westward to join the Golden Square sewers through Upper James Street, and eastward by a pipe-drain to end in the Cambridge Street line already mentioned. 5. Great Pulteney Street has a sewer to itself, running south into a second transverse line which occupies Brewer Street and Little Pulteney Street and, crossing above the Windmill Street line, falls both ways from that point, viz. westward into the Golden Square system and eastward into the Wardour Street sewer.

b. Atmospheric connection.—Of the five systems of sewers just described the *first* (pink) has atmospheric connection with the *second* (blue) at the high level in Marshall Street near the end of South Row. The *first* and *third* appear to be connected atmospherically by the Great Marlborough Street line. The *fourth* (Silver Street) is connected with the *second* at the junction of Cambridge and Little Windmill Streets, and with the *fifth* (Brewer Street) through the Golden Square sewers. The *fifth* is further connected with the *third* (Wardour Street) at the end of Little Pulteney Street. Lastly, the *second* and *third*, occupying respectively the two halves of Broad Street, have only an indirect and circuitous atmospheric connection.

At the period of the Cholera outbreak it was

very generally believed that the unusual mortality was in some way or other chiefly attributable to the sewers themselves or to their alteration and extension in certain parts of the district in 1851 and in the winter of 1853-4. 1st, because of the disturbance of the ground of the old pest-field already alluded to; 2ndly, because of the general disturbance of the artificial soil, the removal of good gravel and the subsequent filling in with rubbish; 3rdly, on account of sundry diversions or changes in the previous current of the drainage; 4thly, because of the foul and loaded condition of the sewers, and the escape of noxious air from the numerous ventilators and untrapped gullies.

It is not easy to connect the general disturbance of the soil in 1851 and in the winter of 1853-4 with an outbreak of Cholera in the autumn of 1854. Even in the case of the old pest-field such connection is difficult to be conceived, for the reasons which have already been detailed at length. That the opening of old ground for the purpose of building new street sewers should be carefully timed and properly conducted is true; but the vague apprehension that this is necessarily attended with risk to public health may be quieted by the fact that such works were proceeding at the Cholera period in various parts of the metropolis without appreciable evil results.

Before 1851 Marshall Street drained into Silver Street, and the whole of Broad Street, including

Dufour's Place, drained into the Wardour Street sewer. At present the drainage of the former street flows three ways; its upper part westward through Tyler Street; its middle part eastward along Broad Street to Cambridge Street; and its lower part only into Silver Street. Only the eastern half of Broad Street now drains into Wardour Street. Moreover, the sewers in the two halves of Broad Street are not directly connected. Hence, as Mr. Cooper has remarked, the diversion of the sewerage cannot have had much to do in itself with the increased mortality, the deaths being distributed pretty equally over the two districts east and west of Cambridge Street, and even over the two halves of Broad Street separated at the point where the new and old sewers approach without joining. But whether incidentally this diversion of the drainage could have had any injurious effect is a point for further examination.

Of the escape of foul, nauseating and noxious vapours from the untrapped gully-holes and ventilators throughout the district, there can be no doubt. Particular evidence of this fact, as regards the 30th and 31st August, could easily be brought forward. Owing indeed to the previous long-continued absence of rain and the great heat of the four previous days, this was the case all through the metropolis, even in parts lightly visited by Cholera, as in Regent Street, in St. Giles' Holborn, and in the northern parts of London. One cannot

suppose then that the general condition of the sewers in this district was different from that in others where Cholera was scarcely felt. But it remains to be asked, were there any special circumstances or peculiarities in the sewerage of the affected districts?

The improbability of the pest-field soil contaminating the sewers has already been discussed. From the Baths and Wash-houses, the Brewery and certain factories, a considerable quantity of hot water continually passes down through these sewers. It is quite certain that this might locally aggravate the smells from the sewer-atmosphere by increasing its temperature and moisture. So also the acid fluids passing from time to time along them from factories in the neighbourhood might, by meeting with sulphide of ammonium, set free sulphuretted hydrogen and thus add materially to the noxiousness of the escaping effluvia. But the detergent effect of a large quantity of hot alkaline and other waters, unmixed with solid matter, continually flushing the sewers, must of necessity be a benefit. In particular it must be added that there is no evidence whatever of Baths and Wash-houses, either here or elsewhere, being in any way specially concerned in increasing the intensity of Cholera.

Of cow-sheds, grease boiling houses, marine stores and slaughter-houses, there are many, especially along the southern half of the Cholera area. Their drainage must pass, some of it into the

Wardour Street system and the rest into the Golden Square system of sewers. One large establishment drains into the short piece of sewer at the lower end of Marshall Street, near Silver Street. There is no surface drainage above, and the house drainage must be insufficient to keep the sewer clear from obstruction. Direct evidence is on record of the accumulation, during last August, of the blood, offal and ordure of animals in the short piece of this sewer, as far as its entrance into the Silver Street sewer and even beyond this point. The presence of such accumulations must hold up the house drainage as far as the corner of Broad Street. There is no gully-hole along this part of the sewer and no ventilator at the top. It forms therefore a closed and underground retort, 200 feet long, its inclined floor being partly choked with animal matter and refuse (the most prone of all to dangerous putridity), partly covered with the closet drainage from occupied houses, and empty only at its upper end. Its beak dips down into Silver Street, into which the products of its distillation must slowly fall. Spreading eastward and westward along Silver Street, and escaping partly at its gully-holes so offensively that sacks were frequently put over them by the inhabitants near whose doors they opened, the products would either be drawn along in the direction of the air-draught in the sewers which, contrary to the water flow, tends towards the higher levels, or, by aid of gravi-

tation or divers currents in the sewers, they might pass in opposite directions before escaping into the streets. In this way the local atmosphere, during the Cholera outbreak, might be seriously tainted, or molecular decomposition, fermentation or organic growth might extend itself along the contents of the loaded sewers of this overcrowded district wherever atmospheric connection existed. It is impossible to say that this sewer-retort would generate any peculiar products, but it would certainly generate more products, and those more quietly than any ordinary sewer. Thus it might aggravate the mischiefs common to all sewerage, and might even constitute a focus of molecular or organic change, by which adjacent accumulations of filth might be more rapidly excited to active decomposition.

Without doubt the general taint of the atmosphere in the southern half of the Cholera district may thus have been specially increased. It is important further to bear in mind that probably no such another example exists, throughout the metropolis, of large slaughtering premises draining into so short a closed sewer, with insufficient head-water to carry away the filth. It must also be remembered that in 1849 this arrangement did not exist; for the surface water and house drainage from a considerable district, including three-fourths of the sewerage from the Workhouse, then operated to wash away the refuse from the slaughter-yard in question.

On general grounds therefore it would seem as if here was one local condition, probably most favourable to the intensity of a Cholera outbreak, and *special*, perhaps, when considered both as to time and place. But there are difficulties in the way of viewing it as a satisfactory explanation of the outbreak itself. No direct *under-ground* atmospheric connection can be traced between the Silver Street sewer and the old sewer in the eastern half of Broad Street; and the communication between them, through the trunk lines of Wardour Street and Berwick Street, is somewhat circuitous, although not many hundred yards about. Nevertheless, when the excessively calm and sultry character of the days immediately preceding the outbreak is remembered, an *above-ground* diffusion of the impure air might be supposed to have been concerned in aiding the spread of the disease, either directly, or else indirectly by inoculating other seats of mischief, such as over-flowing cesspools, existing in that quarter. It has been alleged in the Public Journals that the deaths generally took place in houses opposite to gully-holes and ventilators; but, as stated in our previous remarks upon the map, this was the exception and not the rule.

As to the probable entrance of the sewer air into some houses rather than into others, but little certain is known; for, as already stated, trustworthy evidence can be obtained only in a few cases as to the absence or presence of traps, or their efficiency

or non-efficiency where they exist. In such important particulars it is a matter of regret that the present Report must remain defective. In the case of No. 40, Broad Street, it is evident from Mr. York's account, that the vertical stone in the water-trap, being erroneously placed, could not defend the interior of the house from the gases of the sewer; this may be an example of a very general rule. It is known also that, when the main sewer was sunk, many house-drains, instead of being lowered, were simply connected by an invert pipe entering too near to the top of the new sewer arch. It has been asserted that where houses had leaden flap-traps to the drains no deaths from Cholera took place, and vice versâ. In the upper part of Marshall Street, 6 houses are known to have had these flap-traps inserted, and in 4 the drains were properly lowered; in these no deaths took place. But opposite facts are to be met with. In two factories in Broad Street, the closet accommodation, water supply and traps are equally complete; yet in one 7 deaths, out of 42 persons employed, took place; in the other, out of 30, none. In the large factory, employing 200 people of whom 18 died, the closets are well arranged and attended to daily. It is moreover shewn by Mr. Whitehead that in Broad Street the kitchen population did not suffer so much nor yet so early as persons living on some other floors, but that the per centage of mortality diminished from the ground-floor upwards, with the exception of a slight increase on the third

floor over the second. Of the 26 deaths in Little Windmill Street, the kitchens, with inmates relatively as numerous and drains as offensive as in Broad Street, did not supply a single one. In remoter streets a slight preponderance of deaths on the upper floor is observable. Hence it would seem that, if the sewage gases operated at all, they would do so by diffusion into the street atmosphere rather than through the house drains. But here also difficulties arise. If the air was so generally tainted, how did so many of the inhabitants escape? why did not the men employed in Huggins' Brewery suffer, when out of 35 of those engaged, close to that establishment, in the construction of the then unfinished lodging houses called Ingestre Buildings no less than seven died? why did not the inmates of the Workhouse suffer more than they actually did? why should adjoining houses, and families living in one house and on the same floor, have presented similar contrasts?

Although therefore there must have existed abundant causes of an impure condition of the atmosphere in the sewers, drains, basements and even courts and streets, during the hot still days at the end of last August; although the general pernicious effects of this are undeniable; and though a comparison of the Cholera area of St. James's in this respect with other districts may be unfavourable to the former; yet a minute inquiry into the details of the Cholera outbreak shews that

the precise influence of this extreme, if not special, foulness of the local atmosphere cannot be satisfactorily defined, and that it fails by itself to explain the apparent anomalies of the remarkable outbreak of Cholera in this parish.

Public Water Supply.—The western half of the "Cholera area" in this parish is supplied with water by the Grand Junction Company; whilst the eastern part, corresponding very nearly with the Berwick Street registration sub-district, is supplied by the New River Company. It is obvious therefore that the public water supply from these two companies either had some equal and simultaneous share in favouring the Cholera outbreak, which seems very unlikely when we consider the suddenness and limited extent of that outbreak, or, what is more certain, had no share at all.

The Grand Junction water has, according to Dr. R. D. Thomson, an average amount of 14·46 grains of solid matter in a gallon: the New River water at the reservoir, New River Head, a normal quantity of 17·18 grains. But, during the Cholera outbreak, some of the water supplied by the New River Company, collected from houses in the Soho district adjoining Berwick Street, has been stated to have contained 30 grains per gallon.

It is right to mention here with proper emphasis that, although no influence whatever was probably exerted by the public water supply in increasing Cholera in St. James' parish, the condition of the

water butts and cisterns, as stated in the Visitors' inquiry lists, must have been exceedingly bad. Particular instances the Committee forbear to mention; but enough was revealed to make them hope for the speedy abolition of the cistern and for the consummation of the long advocated plan of a constant supply. Often these butts and cisterns are without covers; and, very frequently, owing to the smallness of the back yards, they are in close proximity to accumulations of dirt. As mentioned by Mr. Whitehead, their state was a frequent reason for having recourse to the well water of the district for drinking purposes, to the character and effects of which we must next direct attention.

Well Water supply.—Besides the Artesian well sunk near St. James's Church, Piccadilly, there are many wells, public as well as private, scattered through the parish, all of which must essentially derive their supply of water from the abundant land springs which exist in the sand lying above the clay. This sand, it may be stated, is continuous with beds extending all through the gravel district westward across Hyde Park, and derives its water partly from the rain-fall on the open country and partly from the surface water and accidental drainage from the soil of the inhabited districts.

These pump-wells vary in depth, but all of them are sunk down to the London clay, which serves as their bottom; the sides are built in brick, laid dry, through which the water readily enters; the

arches are turned over with brick, laid in mortar or cement, and covered in with a key-stone also secured in mortar or cement. A section of the well in Broad Street is shewn with Mr. York's Report, which may be read with advantage here.

Now there are two of these wells in the parish, one in Marlborough Mews in the north, the other in Little St. James's Street in the south, which are so rapidly fed from the water-bed in the sand that they cannot be pumped dry; whilst the majority of them, as those in Bridle Lane, Charles Street, Duke Street and Broad Street, can be laid dry by continuous pumping in four or five hours. Since therefore into these last-named wells the natural supply finds a less ready entrance, it is obvious that the chances of soakage from the artificial soil and the numerous impurities incidental to densely inhabited districts are greatly increased.

In November 1854, in consequence of the relation then declared by Dr. Snow to have existed between the well-water in Broad Street and the Cholera outbreak, Dr. Lankester was requested to report on the well-waters of this parish. In his Report it was shewn that the Broad Street well-water contained 96 grains of solid matter to the gallon, the Bridle Lane water 96 grains, and the Marlborough Street water 50 grains; whilst the water from Marlborough Mews (a quick filling well) contained only 30 grains. The water from the Burlington Gardens well, which is also fed very rapidly, contained 32 grains per

gallon, a fact supposed by Dr. Lankester to be exceptional, but coinciding nearly with the quick filling well of Marlborough Mews. But it was desirable to ascertain if possible what was the standard composition of the water natural to the sand bed, without admixture from a town soil. The Artesian well-water in Piccadilly contained, when first bored, 40 grains per gallon, and no organic matter (Everett); that in Trafalgar Square contains 67 grains per gallon (Graham); and Thames water a quantity varying from 14 to 38 grains. But neither of these analyses afforded the necessary data. Two specimens of water have therefore been procured from Hyde Park, one from a pump near Kensington Gardens, the other from the running pipe at the east end of the Serpentine. A sample from the Marlborough Mews well, one from a private well in Savile Row, and two samples from the Broad Street well have also been examined. Of the Broad Street samples, the first was taken six weeks from the date of Mr. York's detection of a communication between the well and the cesspool of No. 40, during the whole of which period the well was closed; the second after the well had then been pumped out three several times and allowed to fill again. The results are stated in the following Table, to which also is added the composition of Thames water taken at Kew, whence the Grand Junction Company derives its supply.

	Spring at the Northern end of Kensington Gardens. Collected 4th June, 1855.	Hyde Park, near the Serpentine. Collected 1st June, 1855.	Marlborough Mews. Collected 2nd June, 1855.	Private Well. Collected 5th June, 1855.	Broad Street. No. 1. Collected 9th June, 1855.	Broad Street. No. 2. Taken after three pumpings out of the Well, 14th June, 1855.	The Thames at Kew; the source of supply of the Grand Junction Company.
Specific Gravity,	1000·454	1000·377	1000·438	1000·997	1000·998	1000·873	
	Grains in Imperial Gallon.						
Carbonic Acid,	8·214	9·170	14·299	13·888	26·374	24·644	5·39
Chlorine,	2·593	2·808	3·413	7·504	11·240	10·592	·84
Sulphuric Acid,	9·511	13·860	9·890	10·150	12·970	12·970	2·31
Lime,	6·051	11·765	10·280	17·542	23·998	23·347	7·42
Magnesia,	2·593	2·754	1·607	1·428	1·944	2·161	·56
Soda,	4·430	2·156	& Potassa about 6·500	7·580	16·861*	16·861	·84
Potassa,	0	0	See Soda.	0	0*	0	·56
Iron,	Trace.	Trace.	Trace.		Considerable.	Not quite so much.	(Peroxide) ·63
Phosphoric Acid,	Trace.	Trace.	Trace.	Trace.	Trace.	Trace.	(Silica).
Nitric Acid,	Trace.	Trace.	Considerable.	Considerable.	Much.	Very much.	Trace.
Ammonia,	0	0	Considerable.	Trace.	+	+	·42
Organic Matter,	5·404	3·080	·432	5·404	5·404	4·755	3·08
Total estimated	38.796	45·593	46·421	63·496	98·791	95·330	22·05
Residue after Evaporation, 212° Fh.	45·388	50·404	56·000	80·388	107·015	105·933	
Analysed by	W. J. Powell.	T. J. Smith.	P. Worsley.	J. Ormsby.	W. J. Powell.	W. J. Powell.	Graham and Hoffmann.

* This was not estimated, but inferred from Specimen No. 2.

† In Specimen No. 2, the process for detecting Ammonia was interrupted by an accident. Ammonia no doubt existed in both Specimens.

It will be seen that the general result of these analyses is to confirm the differences already found by Dr. Lankester to exist between various well waters of this Parish. The quantity of chlorine, combined probably with sodium to form common salt, is remarkable, especially in the Broad Street water. It is so great, indeed, that it must be derived from the debris, refuse, and excreta, necessarily accumulated in a densely peopled district, and not from the waste water of the neighbourhood, which is supplied by the Grand Junction Water Company from the Thames at Kew, where the river water contains, as is shewn, a very small quantity of chlorine.

Phosphoric acid, existing either as a soluble phosphate, or as a phosphate of lime dissolved in carbonic acid, is present in minute quantity in all the waters. The nitric acid, which most likely exists in combination with ammonia and lime, and which is found in large quantity in the Broad Street water, would be derived from decayed animal matter, probably from mortar rubbish or even the pest field soil. The carbonic acid originates also from decomposing organic, chiefly vegetable, substances, and is either free or associated with lime or its salts. The sulphuric acid would also be combined with the lime and magnesia to form sulphates. Sulphate of lime is a natural constituent of nearly all spring waters. No sulphuretted hydrogen or sulphide of ammonium existed in any of the specimens. Organic matter was found in all.

From a general comparison of the well waters it would appear; first, that in the open park uncovered by houses the water of the sand-bed is comparatively free from saline constituents, especially from chlorides and nitrates, though it contains a large quantity of organic matter; secondly, that when traversing with great rapidity and freedom of percolation through the soil of an inhabited district, to feed a quick-filling well, it acquires a decided increase of saline ingredients, including both chlorides and nitrates; and, thirdly, that in a particular well, in which the rise of water is slower, still more of these impurities were found, not only under the influence of percolation from an obstructed cesspool but also after the effects of such percolation had been to a great extent removed by improvements in the drains and repeated emptying of the well.

The contamination of the water in the well in Broad Street by filtration from a cesspool during the time of the Cholera outbreak is rendered certain by the result of Mr. York's investigations made in April; for the condition of matters then revealed must have been of some duration. Nor is there anything wholly without parallel in these disclosures. Seventeen years ago this same cesspool was opened on suspicion of contaminating the well water, and the suspicion proved to be correct. Many years ago closet-soil was found running down the sides of the well in Warwick Street; gas has been detected in the Tichborne Street and Bridle Lane

wells; and enormous quantities of black-beetles were found in the well (since closed) in Marylebone Street.

The gross impurity of the water from the pump in Broad Street being fully established, it is equally true that it was in great repute through the neighbourhood for drinking purposes. Its use indeed was very general, from choice on the part of some, from necessity on that of others, as their own cisterns were foul and the water in them was liable to get heated and decomposed. It is remarkable that pump water so impure was so much liked; this might be partly explained by its low temperature, by the quantity of carbonic acid contained in it, and by the saline matter preventing its decomposition until after it had free access to the air; but evidence exists to shew that when so exposed for a few days it became offensive; even in a few hours it lost its freshness.

It was Dr. Snow who first endeavoured to trace out a relation which, from previous researches in other quarters, he supposed might exist between the use of this well-water and the Cholera outbreak in the surrounding districts. The result of his laborious inquiry was in favour of that supposition. Mr. Whitehead, entertaining at first adverse views, ended his special investigation of Broad Street by a remarkable confirmation of Dr. Snow's numerical results. For full particulars as to these two independent investigations, reference must be made to

their respective reports, which are inserted hereafter. A careful perusal of them is here recommended.

It is shewn by Dr. Snow; 1st. That the outbreak, properly so called, was principally confined to the area about the Broad Street pump. 2nd. That 61 out of 73 persons who died during the first two days had been accustomed to drink the pump water either constantly or occasionally. 3rd. That the water was used in various other ways, and might so have been taken in cases where its use in the ordinary way could not be distinctly traced. 4th. That in the Workhouse, where the well water was not used, only five deaths occurred, whereas 50 would have been a ratio proportionate to that of the neighbourhood around. 5th. That in a factory employing 200 people, where the water was drunk daily, 18 people died. 6th. That 70 men, employed at the Brewery in Broad Street, never drank the water, and escaped Cholera. 7th. That in a number of individual instances which were particularly investigated, the drinking of the water was followed by Cholera: in one case, a lady living quite away from the district, who had the water sent out to her, died after drinking it; her niece also died under the same circumstances. 8th. That at any point decidedly nearer to another pump the mortality from Cholera, as a rule, ceased; and that, in an inquiry extending over 48 fatal attacks which took place nearer to another pump, many

apparent exceptions were found to be cases of death in persons who really had a preference to the more distant Broad Street water. 9th. That in a particular street, containing fourteen houses, the only four which escaped without a death were those in which the Broad Street water was never drunk. 10th. That this water was employed for drinking purposes only, and was used cold;—a statement which we may so far anticipate as to say is confirmed by the experience of Mr. Whitehead, who met with but a single exception to this rule. From all these several facts Dr. Snow is of opinion that, although the early cases of Cholera and the later cases were due to some other mode of diffusion, the outbreak between the 31st August and the 10th September was attributable to the well-water as the medium of dissemination of the Cholera poison. He believes moreover that the well-water must have been not merely generally contaminated by cesspool drainage, but specially with the evacuations of a Cholera patient.

Mr. Whitehead's investigation of Broad Street shews; 1st. That of the 90 fatal attacks among its resident population, 84 took place between 31st August and 6th September, 56 between 31st August and 2nd September, and 50 on September 1st and 2nd. 2nd. That of the 90 deceased persons 45 positively drank the water shortly before illness; and that of only 13 altogether is it at all confidently said that they did not

drink it. Moreover, that of the above-mentioned 84, the non-use of the water is asserted of only 8; and of the 56 persons attacked between 31st August and 2nd September, it is positively affirmed of only 2 that they did not drink this water. 3rd. That undoubtedly of 100 persons residing in Broad Street, who were attacked with Cholera or Diarrhœa (including dead and surviving), 80 drank the water, whilst 20 are affirmed not to have drunk it; whereas out of 336 persons living in that street and who were not attacked with either disease, only 57 had drunk the water, whilst 279 had not. 4th. That there is a great probability that the numerical proportions were even more remarkable than this, all cases involved in any doubt having been rejected. 5th. That in regard to the two factories situated next door to each other, both equally well arranged in regard to other sanitary conditions (see page 26), the workmen of one in which the mortality was high had the water for drinking purposes, whilst those of the other never drank it, and entirely escaped,—the former fact being strengthened by the circumstance that the family of the proprietor never used the water and did not suffer. 6th. That, in addition to the contrast pointed out by Dr. Snow as regards the exemption from Cholera on the part of the 70 men employed at the Brewery where the water was not drunk, and the amount of suffering amongst the 200 persons engaged at a neigh-

bouring factory where the water was drunk,—a contrast even more remarkable is found between the workmen of this Brewery and those engaged on the closely adjoining unfinished lodging houses called Ingestre Buildings; for amongst these latter the water was in use, and Cholera proved fatal to 7 out of 35. 7th. That of 97 people residing in 10 houses in which no attack occurred, 87 did not drink the water at all, whilst the remainder did not drink it during the height of the outbreak, or drank it either in small quantities or mixed with spirits. 8th. That in a great number of particular instances, narrated at length in pages 136 to 145 (paragraphs 4 to 15) the evidence of an injurious influence exercised by the water becomes strengthened as the inquiry becomes more strict and searching. 9th. That the want of good sanitary arrangements in certain houses operated by compelling the residents to resort to the pump for drinking-water; and that, on the contrary, in certain instances where the drains were in good order, the cisterns were clean and the inhabitants did not send to the pump*. 10th. That through the district generally the aged and infirm, when isolated, escaped, not merely because they had more house accommodation, but because they did not use the water, having no one to send for it. 11th,

* In regard to 4 out of the 6 houses in Marshall Street mentioned in p. 67, it has been positively ascertained that this was also the case. The then occupiers of the other 2 are now beyond reach.

and lastly, that on looking beyond Broad Street to certain cases at a distance from the pump, a remarkable amount of evidence still presents itself in support of the facts observed in its immediate vicinity. (See p. 167.)

Not guided, however, by individual instances, but viewing the accumulated evidence, of which the preceding is but a brief abstract, one is unable to avoid the conclusion that there existed some connection between the use of the well-water in Broad Street and the subsequent suffering of the neighbourhood from Cholera.

The well-established exceptional cases mentioned by Dr. Snow and Mr. Whitehead, as opposed to this conclusion, are comparatively few, and appear insufficient to neutralise the general result.

It is remarkable that, of the two suppositions, first, that the air alone, and secondly, that the water more especially, was concerned in exciting the disease, whilst the former appears less and less equal to explain individual cases in proportion as these are examined more and more in detail, it is precisely in the variety and exactitude of its particular application to individual facts that the latter finds its most positive support. Moreover, in estimating the value of the facts put on record by Dr. Snow and Mr. Whitehead, it must be remembered that the former seized the important advantage of an early inquiry, and that the latter balanced the disadvantages of delay by his

previous knowledge of the district, the people and the outbreak, and by the gradual and cautious character of his investigation. It must also be borne in mind that the weight of both positive and negative evidence appears to be clearly and unmistakeably in one direction, viz.—to shew that the water had some preponderating influence in determining an attack. If it be supposed that the drinking of the Broad Street water by those who died was a mere coincidence dependent on, and to be expected from, the fact that so many persons in the neighbourhood, especially in Broad Street, constantly drank it, it must be remembered that this fact of coincidence also bears with greater force on any mere atmospheric hypothesis; for whereas of those in Broad Street itself who during the great outbreak coincidently breathed the air one only in ten died, on the other hand, of the coincident water drinkers, who of course were fewer in number, a much larger proportion was fatally seized. If some idiosyncrasis or resisting power be assumed to explain the escapes amongst the air-breathers, it must equally be admitted in aid of those of the water drinkers who did not suffer; and it is obvious that the demands upon so unsatisfactory an explanation are much smaller in the latter than in the former case. If it be urged, in explanation of an atmospheric influence, that Cholera might be conveyed exclusively to some by a partial distribution of an impure air, it may be

replied that no consideration of the streets, local levels, sewer-grates, house drains, or direction of the wind, will explain the existence of such partial atmospheric impurity, whereas the individual use of the water has been actually traced, and its consequences may be not unreasonably inferred.

Anxious to give due weight to every fact and consideration that have offered themselves in this inquiry, the Committee is unanimously of opinion that the striking disproportionate mortality in the "Cholera area," as compared with the immediately surrounding districts, which, to quote the words already used at the commencement of this section of the Report, constitutes "*the sudden, severe and concentrated outbreak*," beginning on August 31st and lasting for the few early days of September, was in some manner attributable to the use of the impure water of the well in Broad Street.

In this conclusion the Committee finds support from the gradually accumulating evidence collected in other localities, as to the important influence of contaminated water in increasing Cholera, especially in the districts of the metropolis lying south of the Thames, wherein, as stated by the Registrar General,—"the balance of "mortality is heaviest in every district and in "every week against the impure water to an "extent that leaves little room for doubt on the "mind." Moreover, alluding to the Registrar-

General's inquiries, Dr. Sutherland has remarked —" it is difficult to resist this statistical evidence " of the predisposing effect of the Battersea water, " and of the loss of life which has arisen from " its use."

It will presently be discussed what may have been the manner in which the water from Broad Street produced its effects.

HYPOTHESES CONCERNING THE OUTBREAK.

The attentive observer of the history and accompanying circumstances of this remarkable Cholera outbreak will readily trace in its principal features, with all its apparent anomalies and enigmas, an epitome of those wider visitations which have spread over larger areas. For some time it probably will form a convenient arena within which the advocates of different hypotheses concerning the cause and mode of diffusion of the disease will find abundant materials for scientific disputation.

We may here briefly glance at the leading elements of such a discussion.

In the first place; the generally received opinion that the unknown Cholera agent is material rather than dynamical—a poison rather than an atmospheric, terrestrial or electric influence—is strongly supported by the phenomena of this outbreak; for

the affected district stood alone in its intense suffering although embraced on all sides by closely populated neighbourhoods which almost escaped; and no such influence could well be imagined to confine its operations to so small an area, over-leaping or avoiding the surrounding people. On the contrary, all the facts seem to point to the introduction, importation or invasion, of a *material agent*, either gaseous, liquid or solid, having specific poisonous properties.

Secondly; supposing such a morbific material to exist, it would seem very unlikely that the *total* quantity necessary to produce such direful results as to destroy in three days more than 300 persons within so narrow a circle could have been conveyed at once, and as such, into the district by imported articles of either food or drink, both of which are distributed to the inhabitants not by exclusive arrangements but in common with surrounding parts. Neither could this *total* quantity well be conceived to have been carried to the devoted spot by atmospheric currents without leaving more evident traces of its passage over the neighbouring people, from whatever quarter it might have proceeded. On the contrary, all things favour the idea of its having been introduced in small quantity and then having been *multiplied* within the Cholera area itself.

Thus far inference is tolerably clear. Now however uncertainty begins; for, in the third place, the nature of this hypothetical material agent is abso-

lutely unknown,—whether it be organic or inorganic, itself living, decaying, or altogether unendowed with life.

Fourthly; whether its multiplication, evolution or growth takes place in favouring conditions externally to the human body, and then its influence is exerted upon susceptible persons—or whether it is conveyed to the body in minute quantity, multiplies solely within it, and thus gives rise to the phenomena of the disease—or whether its increase may take place both within and without the body—are questions involved in controversy, to which at present no one can satisfactorily reply. The first view, that of external multiplication, is the one most generally entertained; the second, the doctrine of internal development, has two modifications, one in which the poison is supposed to multiply exclusively in the blood by a true zymosis, the other, advocated by Dr. Snow, which supposes the increase to take place only on the internal mucous surface of the alimentary canal. The mixed hypotheses would of course include various combinations of these opinions.

Lastly; concerning the mode in which the morbid agent reaches the human body and enters into and acts upon its complex apparatus, differences of opinion also prevail,—and the whole question is still undecided. It may be conveyed in the air we breathe, enter the system by the lungs, and so act as a poison in the blood—and this, whether it be

developed only externally to the system or solely within it. On Dr. Snow's hypothesis, it enters in small quantity by the alimentary canal and, there alone developing itself, originates its poisonous effects. On the mixed hypotheses above-suggested, the poison, multiplying externally, may be supposed to enter by the lungs and increase still further in the blood or, multiplying externally, may gain access to the digestive organs and undergo further development therein.

Reverting now to the entire range of circumstances connected with the particular eruption of Cholera now under consideration, we find;—that the elevation and soil of the affected district are favourable to health; that overcrowding with its concomitant disadvantages was rather more marked than in adjacent districts; that local circumstances connected with the sewerage, under the influence of peculiar and temporary meteorological conditions, may have caused a special impurity in the air; that the public water supply could not be accused of exercising any pernicious effects; lastly, that the well water used for drinking was without doubt excessively impure.

Looking abstractedly at the possible media by which the Cholera agent might be rapidly diffused, beyond the limits of a household, through an area so large as the affected district of St. James's, we are practically limited to two, viz. air and water; for solid bodies, such as food, clothes, or

living domestic animals, could not have formed adequate vehicles for its transmission; and its direct conveyance from person to person, in the strict sense of contagion, is a wholly inadmissible supposition. In this particular instance reasons have already been given for believing that the explanation which refers this singularly sudden and severe explosion chiefly to the use of the impure drinking water is more conformable to the facts than that which refers it to atmospheric influences only. In what way then did this water operate? As the vehicle of a predisposing, an accessory, a collateral and specific, or a simple specific agency? Various hypotheses may be entertained.

1. The undeniably impure well water, impregnated with matters from the cesspool and the soil, may have acted, not specially but only as a predisposing cause of the outbreak, by occasioning a gradual deterioration in the health of those who drank it or a more sudden change in the condition of their fluids, either of which may have rendered them more liable to the invasion of the disease or less able to resist it if attacked; or the water acting as an accessory cause may directly have enhanced the activity or aggravated the effects of the real morbific agent.

In either case the true Cholera agent or special cause of Cholera would be supposed to be conveyed through the air, being generated solely, under favouring conditions, *on surfaces exposed to*

the air, or *in the air* itself previously rendered impure by exhalations from sewers, cesspools, masses of filth, or the human body; or being developed solely *in the bodies* of persons predisposed to the disease; or being increased *in both ways.*

2. The water may have acted collaterally and specifically by yielding something necessary to the development, disengagement, or operation of the true morbific agent;—in a word, as the vehicle of one of a series of coefficients indispensable to the production of the disease.

On this hypothesis, one or more equally necessary coefficients may have been conveyed through the air, or by means of food, or might exist or be produced in the bodies of persons who were to be attacked.

Cases not traceable to the water may have been due to the combined action of the same coefficients conveyed in other media.

3. The water may have played a more direct part, as the vehicle of a specific poison,—and this, in various ways.

a. Thus, as Dr. Snow believes, such poison may have entered it in the evacuations of some patient who had Cholera or Choleraic Diarrhœa immediately antecedent to the great outbreak,—the poison being supposed thus to have been conveyed in minute quantities from one person to many, and then to have been multiplied *in their bodies* in contact with the alimentary mucous membrane.

Cases not traceable to the water he supposes to

be due to some other mode of introduction of a minute quantity of the poison into the digestive tube, and its subsequent and sole development there.

b. Another mode in which the water might act as a medium for the transmission of a poison would be both by contamination of the well by a special agent in the intestinal or urinary excretions from a patient labouring under Cholera or Choleraic Diarrhœa, and by subsequent multiplication or development *out of the human body, as well as in its interior*, as for example in the contents of the cesspool or in the impure water itself, with which latter it would then be distributed.

c. Again, without supposing the existence of any special poison in the Cholera evacuations, the water of the well in Broad Street may have become impregnated by the Cholera agent in another way, and so have become the vehicle of its transmission. Thus, the Cholera poison being multiplied, by chemical change or organic growth, *external to the human body only*, may have reached the cesspool in the area of the house close to the well, either through the general atmosphere or through the sewer-atmosphere, and may then have established itself and multiplied under favouring conditions of stagnation and high temperature, either in the atmosphere of the cesspool or on the surface of the impure accumulations in it, and have been finally washed over into the well by fluids cast into the cesspool at the time.

d. Lastly, the same processes might occur as are

supposed in the last hypothesis, with the addition, that, having so gained access to the well, the poison may have further increased or multiplied, previous to its distribution, in the impure well-water itself.

On either of these last three suppositions cases not traceable to the water might be supposed to be produced by the contamination of other fluids or of bad food by some portion of the poison, gaseous, vaporous, or in dry particles, thus inhaled or swallowed into the stomach.

Other ways yet may be conceived in which the water of the well in Broad Street may have become impregnated with a specific poison capable of producing Cholera, or may have indirectly contributed to determine an attack.

The Committee refrains however from expressing an opinion in favour of any hypothesis of its mode of action.

Two questions deserve some attention, viz. the nature of the contamination of the well-water, and the relation of the local outbreak in St. James's to the general epidemic throughout the Metropolis.

Nature of the Contamination of the Well-water.—At the time of Dr. Snow's inquiry in the early part of September 1854, and indeed up to April 1855, when Mr. Whitehead's investigation was complete, the entrance of sewer or cesspool-drainage into the well in Broad Street was not proved. All the evidence was to the opposite effect. Subsequently however, as already explained, the basement of the house No. 40 was found to have atmospheric connection with the street sewer, and the cesspool to be so choked and defective as to have allowed percolation into the soft black soil around, and thence into the well itself.

Beyond this, it is proved by the statements of Mr. Whitehead and Dr. Rogers that Diarrhœa had affected certain inmates of that house just anterior to the Cholera outbreak; and, in particular, it is pointed out by Mr. Whitehead that the great outburst followed immediately after there had

been thrown into the cesspool, on the 28th, 29th, and 30th August, considerable quantities of water containing the diluted dejections of an infant who is registered as having died on the 2nd September of exhaustion after Diarrhœa. Although, singularly enough, this case is published by the Registrar-General among the Cholera deaths, there is necessarily a doubt as to the real nature of the attack. On the one side, the previous history of the child, the presence of only certain symptoms, and the opinion of Dr. Rogers, the medical attendant, have great weight; whilst, on the other, it must be noted that Cholera symptoms are rarely well marked in the young, and that the Diarrhœa which prevails during a Cholera epidemic is now generally admitted to be choleraic, and due to the same cause as Cholera itself. There was, moreover, some probability that a child already prone to infantile Diarrhœa might become the victim of a choleraic seizure.

Unfortunately no microscopic examination of the water was made earlier than September 3rd. On that day it was found by Dr. Snow to contain minute whitish flocculi, described by Dr. Hassall as destitute of organisation; it also contained some oval animalcules, but no portions of digested food are mentioned. Six weeks later Dr. Lankester discovered in it living and dead vegetable and animal organisms, together with shapeless débris.

It is evident therefore that microscopical and chemical analysis only confirm the matter-of-fact existence of much organic, as well as inorganic, impurity in the water; and that neither scrutiny has served to detect anything which could be pronounced peculiar to a Cholera period or capable of acting as a predisposing, co-operating, or specific agent in the production of that disease. But this need not excite surprise; for although the dangerous character and serious influence of impure water in increasing the mortality from Cholera in other localities is now unquestionable, no ingredient to which any special action could be assigned has yet been detected in such water by the most refined appliances of scientific research; nor indeed, in regard even to the atmosphere itself during a Cholera epidemic, has the strictest investigation hitherto led to any satisfactory revelations.

If however we may found an argument upon the fact that other well-waters in the same neighbourhood containing much the same recognisable organic and inorganic impurities did no harm, and that the Broad Street water itself, in 1832 and 1849, when it was probably also extensively used for drinking, and must have been charged with very similar general impurities, produced no perceptible deleterious effects, we may admit the possibility that its apparently fatal influence in determining the brief but severe explosion last autumn, was owing, not to a general impurity, but to the temporary existence of some special contamination.

Relation of the local outbreak in St. James's to the general epidemic throughout the Metropolis.—It is quite unnecessary to look beyond the Cholera area of St. James's and St. Anne's to perceive that the well-water in Broad Street was not in all cases the means by which a choleraic seizure was determined; for, as already stated, there were persons within that area who died of Cholera without having drunk the water,—some before, some after, and some during the great outbreak.

The occurrence of such independent cases is an important incident in the local visitation; but the questions suggested by them merge in the consideration of the general mortality throughout the Metropolis, away from the neighbourhood of Broad Street altogether.

From the fact, more than once alluded to in this Report, that the height of the local outbreak in St. James's corresponded with the period of greatest mortality throughout the rest of the Metropolis, it has already been inferred that probably some general conditions were at work, simultaneously influencing the operation of the Cholera agent throughout all London; and hence it follows that any conclusions arrived at concerning this local outbreak require to be checked or tested by a reference to the phenomena of the general epidemic. Rightly to employ this test, however, would demand, what is now quite unattainable, a uniform investigation of the whole metropolitan Cholera field.

A comparison of the *daily* deaths from Cholera in all London with those in St. James's and St. Anne's would illustrate the characters of suddenness and severity in the local outbreak even more forcibly than the weekly returns contrasted in the Table at p. 14. Such a comparison now appears in the Appendix, where it is further shewn that, by deducting the disproportionate local mortality of the outbreak, the remaining daily deaths in the rest of London cease to exhibit so marked an increase on September 1st and 2nd; and if we further reflect that this remainder is itself largely composed of the results of smaller local outbreaks, such as those in Deptford and Rotherhithe, it follows that, the residual influence of Cholera at that period being still further diminished, the number of daily deaths dependent upon it would shew greater uniformity.

The simultaneous occurrence of these local outbreaks itself points to some general favouring condition, subject however—in ways perhaps not always recognised—to certain much more directly influential local circumstances. Hence, although it is most unphilosophical to reject the broad conclusions founded on the study of a wide spread epidemic, it is equally so to disregard such more limited deductions as may be derived from the investigation of a local outbreak, or to refuse the light which these latter may perchance reflect on the varied and often perplexing phenomena of a general visitation.

RECOMMENDATIONS OF THE COMMITTEE TO THE PAROCHIAL AUTHORITIES.

In making the following recommendations which naturally flow from the conclusions established in the preceding Report, the Committee cannot omit to remark that whilst the sanitary advantages of the Parish of St. James's are mainly due to natural circumstances, the disadvantages are artificial and removable. The Committee is of opinion:—

1. That, in carrying out any future improvements or in making any public alterations in the parts of the parish affected by Cholera last year, care should be taken to remember the importance of opening more direct lines of communication between several of the streets, and of getting rid where possible of streets or courts closed at one end.

2. That the building of model lodging-houses be still encouraged in place of the existing residences for the families of working men.

3. That efforts be made to abolish slaughter-houses, cow-sheds, grease boiling houses, store-houses for bones, and other offensive places of business from this and all other densely inhabited districts.

4. That attention should be frequently called to the state of the public sewers, especially near to any slaughter-yard or cow-shed, and also generally in very dry weather to the condition of the small

or feeding sewers; and that means should be provided for flushing them when necessary. That such alterations as that suggested by Mr. York, by which he proposes to convey a large supply of surface water into the lower end of the Marshall Street sewer, should be encouraged and carried out.

5. *That, not only on the ground of their liability to special contamination, but from the fact of their constant, habitual and unavoidable impurity, the surface wells of the parish be no longer allowed to be resorted to for drinking purposes.*

The Committee is even prepared to recommend that these wells be closed altogether, and that stand pipes connected with the water mains be erected at certain places for public use.

The committee would further impress upon the parochial authorities the desirableness of again reviving the discussion as to the propriety of sinking one or more Artesian wells for the entire supply of the parish.

6. *That, as a first duty, strenuous efforts be made to realize the long talked of abolition of cisterns and the introduction of the method of constant supply.*

7. That a medical inspector of the parish be appointed, by whose aid important information would be continually collected, and the sanitary condition of its overcrowded portions incessantly watched, and whose duty it would be to forewarn the authorities of the existence of causes, calculated

to be detrimental to health, which, under existing arrangements, lie dormant, or accumulate to produce some unexpected and overwhelming calamity. The position and duties of such an officer would enable him to teach the poorer inhabitants many useful lessons on matters relating to private and public health, and to discover and remedy many unsuspected causes of individual and public disease.

8. That a list or code of sanitary instructions be drawn up and printed for periodical distribution amongst the inhabitants of the parish.

Sub-Committee.

EDWIN LANKESTER, M.D., *Chairman.*
HENRY BIDGOOD,
RICHARD KING, M.D.
JOHN MARSHALL, F.R.C.S., *Reporter.*
HENRY WHITEHEAD, M.A.

JEHT. YORK, *Secretary.*

25th July, 1855.

Dr SNOW's REPORT.

Having been requested by this Committee to draw up a Report on the water used in the locality so severely visited by Cholera, I beg to lay the following statement before you:—

The water supply of the district consists of that of the water companies and that of the street-pumps. The sub-district of Golden Square is supplied by the Grand Junction Company, with water from the Thames, facing Brentford, at Kew, which is almost entirely freed from animal and vegetable impurities before it is distributed. The sub-district of Berwick Street is supplied by the New River Company; the division between the companies being exactly that between the two sub-districts of the parish just named. The remaining districts supplied by the Grand Junction Company have been remarkably free from Cholera, both during the present year and in 1849; and most of the districts supplied by the New River Company have also been lightly visited by the malady on

both occasions; there is, therefore, in my opinion, no reason to suppose that the water of either of these companies contributed to the late outbreak of Cholera. One circumstance which remarkably confirms this view is, that the outbreak commenced on the same day, and almost at the same hour, in both sub-districts; and if it were possible that any pollution of the water supply of the two companies could have taken place, we cannot suppose that it would have occurred at the same time, and at two adjoining spots, in two systems of pipes in which the supply is derived from such very different sources.

With respect to the pump wells, I found some impurities in the water of each of those which I examined in the first week of September, in the Golden Square district, except the one in Vigo Street. The water of the pumps in Broad Street, Warwick Street, and Bridle Lane, all contained impurities visible to the naked eye on close inspection, in the form of minute, whitish, flocculent particles. The water of the pump in Marlborough Street contained a still larger quantity of organic impurities than the others, and most of the people in its neighbourhood avoided using the water, and sent to Broad Street. In my opinion, mere impurity in the water would not cause Cholera, unless it were of a special kind—unless, in fact, the impurity had proceeded from a Cholera patient. Dr. Lankester has, I believe, particularly examined

the water of the pump in Broad Street, which is situated in the centre of the area in which the mortality from Cholera occurred; and he will, no doubt, inform the Committee of the result of his researches. Dr. Hassall was good enough to examine some of this water, at my request, with the microscope, and he informed me that the particles I have mentioned above had no organised structure, and that he thought they probably resulted from the decomposition of other matter. He found a great number of very minute, oval animalculæ in the water, which are of no importance, except as an additional proof that the water contained organic matter on which they lived. I found that the water also contained a large quantity of chlorides — indicating, no doubt, the impure sources from which the spring is supplied. Mr. Eley, of 38, Broad Street, informed me that he had long noticed that the water became offensive, both to the smell and taste, after it had been kept about two days. A person, at 6, Poland Street, also informed me that he had noticed, for months, that a film formed on the surface of the water after it had been kept a few hours. These are characters of water which is contaminated with sewage.

I inquired of many persons whether they had observed any change in the character of the water about the time of the outbreak of Cholera, and was answered in the negative. I afterwards, however, met with the following important information on

this point:—Mr. Gould, the eminent ornithologist, lives near the pump in Broad Street, and was in the habit of drinking the water. He was out of town at the commencement of the outbreak of Cholera, but came home on Saturday morning, the 2nd of September, and sent for some of the water almost immediately, when he was much surprised to find that it had an offensive smell, although perfectly transparent, and fresh from the pump. He drank scarcely any of it. Mr. Gould's assistant, Mr. Prince, had his attention directed to the water, and perceived its offensive smell.

Whether the impurities of the water were derived from the sewers, the drains, or the cesspools, of which latter there are, I believe, a number in the neighbourhood, I cannot tell. I have been informed, by an eminent engineer, that whilst a cesspool in a clay soil requires to be emptied every six or eight months, one sunk in the gravel will often go for twenty years without being emptied, owing to the soluble matters passing away into the land-springs by percolation.

I requested permission, on the 5th of September, to take a list, at the General Register Office, of the deaths from Cholera registered during the week ending the 2nd of September, in the sub-districts of Golden Square and Berwick Street, St. James's, and St. Anne's, Soho, which was kindly granted. Eighty-nine deaths from Cholera were registered during the week, in the three sub-districts. Of

these only six occurred on the first four days of the week; four occurred on Thursday the 31st of August; and the remaining 79 on Friday and Saturday. I considered, therefore, that the outbreak commenced on the Thursday; and I made inquiry in detail respecting the 83 deaths registered as having taken place during the last three days of the week.

On proceeding to the spot, I found that nearly all the deaths had taken place within a short distance of the pump in Broad Street. There were only ten deaths in houses situated decidedly nearer to another street-pump. In five of these cases, the families of the deceased persons told me that they always sent to the pump in Broad Street, as they preferred the water to that of the pump which was nearer. In three other cases, the deceased were children who went to school near the pump in Broad Street. Two of them were known to have drunk the water, and the parents of the third think it probable that it did so. The other two deaths, beyond the district which this pump supplies, represent only the amount of mortality from Cholera that was occurring before the eruption took place.

With regard to the 73 deaths occurring in the locality belonging as it were to the pump, there were 61 instances in which I was informed that the deceased persons used to drink the water from the pump in Broad Street, either constantly or

occasionally. In six instances I could get no information, owing to the death or departure of every one connected with the deceased individuals; and in six cases I was informed that the deceased persons did not drink the pump water before their illness.

The result of the inquiry consequently was, that there had been no particular outbreak or increase of Cholera, in this part of London, except among the persons who were in the habit of drinking the water of the above-mentioned pump well.

I had an interview with the Board of Guardians of St. James's parish on the evening of Thursday, 7th September, and represented the above circumstances to them. In consequence of what I said, the handle of the pump was removed on the following day.

Besides the 83 deaths mentioned above, as occurring on the three last days of the week ending September 2nd, and being registered during that week in the sub-districts in which the attacks occurred, there was a number of persons who died in the Middlesex and other hospitals, and a great number of deaths which took place in the locality during the two last days of the week, were not registered till the week following. The deaths altogether on the 1st and 2nd of September, which have been ascertained to belong to this outbreak of Cholera, were 197, and many persons who were attacked about the same time as these,

died afterwards. I should have been glad to inquire respecting the use of the water from Broad Street pump in all these instances; but I was engaged at the time in an inquiry in the south districts of London; and when I began to make fresh inquiries in the neighbourhood of Golden Square, after two or three weeks had elapsed, I found that there had been such a distribution of the remaining population, that it would be impossible to arrive at a complete account of the circumstances. There is no reason to suppose, however, that a more extended inquiry would have yielded a different result from that which was obtained respecting the 83 deaths which happened to be registered within the district of the outbreak, before the end of the week in which it commenced.

The additional facts that I have been able to ascertain, are in accordance with those above related; and as regards the small number of those attacked, who were believed not to have drunk the water from Broad Street pump, it must be obvious that there are various ways in which the deceased persons may have taken it without the knowledge of their friends. The water was used for mixing with spirits in some of the public houses around. It was used, likewise, at dining rooms and coffee shops. The keeper of a coffee shop which was frequented by mechanics, and where the pump water was supplied at dinner time, informed me on the 6th of September, that she was already aware

of nine of her customers who were dead! The water of this pump was also sold in various little shops with a tea-spoonful of effervescing powder in it, under the name of sherbet, and it may have been distributed in various other ways with which I am unacquainted. The pump was frequented much more than is usual, even for a London pump in a populous neighbourhood.

There are certain circumstances bearing on the question which deserve to be mentioned. The workhouse in Poland Street is more than three-fourths surrounded by houses in which deaths from Cholera occurred; yet, out of 535 inmates, only five died of Cholera—the other deaths which took place being those of persons admitted after they were attacked. The workhouse has a pump on the premises in addition to the supply from the Grand Junction Water Works, and the inmates never sent to Broad Street for water. If the mortality in the workhouse had been equal to that in the streets immediately surrounding it on three sides, upwards of 50 inmates would have died. There is a brewery in Broad Street near to the pump, and on perceiving that no brewer's men were registered as being dead of Cholera, I called on Mr. Huggins the proprietor. He informed me that there were above 70 workmen employed in the brewery, and that none of them had suffered from Cholera, at least in a severe form, only two having been indisposed, and that not seriously,

at the time the disease prevailed. The men are allowed a certain quantity of malt liquor, and Mr. Huggins believes they do not drink water at all, and he is quite certain that they never obtained water from the pump in the street. There is a deep well in the brewery in addition to the New River water.

At the wire cartridge and percussion cap manufactory, 38, Broad Street, where I understand about 200 work people were employed, two tubs were kept on the premises always supplied with water from the pump in the street for those to drink who wished, and 18 of those work people died of Cholera at their own houses—sixteen women and two men. Mr. Peter Marshall, surgeon, No. 53, Greek Street, was kind enough to inquire respecting seven workmen, who had been employed in the manufacture of dentists' materials at Nos. 8 and 9, Broad Street, and who died at their own homes. He learned that they were all in the habit of drinking water from the pump, generally drinking about half a pint once or twice a day, while two persons who reside constantly on the premises, but do not drink the pump water, had only diarrhœa. Mr. P. Marshall also informed me of the case of an officer in the army who lived at St. John's Wood but came to dine in Wardour Street, where he drank the water from Broad Street pump at dinner. He was attacked with Cholera and died in a few hours.

Dr. Fraser of Oakley Square, St. Pancras, kindly informed me of the following circumstance:—A gentleman in delicate health was sent for from Brighton to see his brother at No. 6, Poland Street, who was attacked with Cholera and died in twelve hours on the 1st of September. The gentleman arrived after his brother's death and did not see the body. He only staid about twenty minutes in the house, where he took a hasty and scanty luncheon of rump steak, taking with it a small tumbler of cold brandy and water, the water being from Broad Street pump. He went to Pentonville, and was attacked with Cholera on the evening of the following day, September the 2nd, and died the next evening.

The deaths of Mrs. E—— and her niece, who drank the water from Broad Street at West End, Hampstead, deserve especially to be noticed. I was informed by Mrs. E——'s son that his mother had not been in the neighbourhood of Broad Street for many months. A cart went from Broad Street to West End every day, and it was the custom to take out a large bottle of the water from the pump in Broad Street as she preferred it. The water was taken out on Thursday the 31st of August, and she drank of it in the evening, and also on Friday. She was seized with Cholera on the evening of the latter day, and died on Saturday. A niece who was on a visit to this lady also drank of the water; she returned to her residence, a high

C.F. Cheffins, Lithog. Southampton Buildings, Holborn.

NOTE. { Boundary within which all the Deaths are indicated, is shown thus, ...
Divisions between Sub-Districts, thus,

SCALE 30 INCHES TO A MILE.

and healthy part of Islington, was attacked with Cholera and died also. There was no Cholera at the time, either at West End or in the neighbourhood where the niece died. Besides these two persons only one servant partook of the water at West End, Hampstead, and she did not suffer, or, at least, not severely. She had diarrhœa.

There were some persons who drank the water from Broad Street pump about the time of the outbreak without being attacked with Cholera, but this does not diminish the evidence respecting the influence of the water, for various reasons.

The deaths which occurred during the fatal outbreak of Cholera are indicated in the accompanying map, as far as I could ascertain them. There are necessarily some deficiencies, for in a few of the instances of persons who died in the hospitals after their removal from the neighbourhood of Broad Street, the numbers of the houses from which they had been removed were not registered. The address of those who died after their removal to St. James's Workhouse was not registered, and I was only able to obtain it in a part of the cases, on application at the Master's office, for many of the persons were too ill when admitted to give any account of themselves. In the case also of some of the work people and others who contracted the cholera in this neighbourhood, and died in different parts of London, the precise house from which they removed is not

stated in the return of deaths. I have heard of some persons who died in the country shortly after removing from the neighbourhood of Broad Street, and there must no doubt be several cases of this kind that I have not heard of. The deficiencies I have mentioned, however, do not detract from the correctness of the map, as a diagram of the topography of the outbreak; for, if the locality of the additional cases could be ascertained, they would probably be distributed over the district of the outbreak in the same proportion as the large number which are known.

The outer dotted line on the map surrounds the sub-districts of Golden Square and Berwick Street, St. James's, together with the adjoining portion of the sub-district of St. Anne's, Soho, extending from Wardour Street to Dean Street, and a small part of the sub-district of St. James's Square, enclosed by Marylebone Street, Tichborne Street, Great Windmill Street, and Brewer Street. All the deaths from Cholera which were registered in the six weeks from August the 19th to September the 30th within this locality, as well as those of persons removed into Middlesex Hospital, are shewn by black lines in the situation of the houses in which they occurred, or in which the fatal attacks were contracted. In addition to these the deaths of persons removed to University College, St. George's, Charing Cross, and other hospitals, and to various parts of London, are

indicated in the map where the exact address was given in the "Weekly Return of Deaths," or when I could learn it by private inquiry.

The pump in Broad Street is indicated on the map, as well as all the surrounding pumps to which the public had access at the time of the outbreak of Cholera. It requires to be stated that the water of the pump in Marlborough Street, at the end of Carnaby Street, was so impure that many persons avoided using it; and I found that the persons who died near this pump, in the beginning of September, had water from the Broad Street pump. The inner dotted line on the map shews the various points which have been found by careful measurement to be at an equal distance by the nearest road from the pump in Broad Street and the surrounding pumps; and, if allowance be made for the circumstance just mentioned respecting the pump in Marlborough Street, it will be observed that the deaths either very much diminish, or cease altogether, at every point where it becomes decidedly nearer to send to another pump than to the one in Broad Street. At these points I ascertained that the people did generally send to the pump which was nearer. It may be noticed that the deaths are most numerous near to the pump in Broad Street, where the water could be more readily obtained. The wide open street in which the pump is situated suffered most, and next the streets branching from it, especially those parts of them which are nearest to Broad Street. If there

have been fewer deaths in the south half of Poland Street than in some other streets leading from Broad Street, it is no doubt because this street is less densely inhabited.

I have made a distinct inquiry respecting the greater number of fatal cases of Cholera that occurred, at the time of the outbreak, within the outer boundary marked on the map, but in a situation very decidedly nearer to another public pump than to that in Broad Street, and the following are the results:—

On the 4th of September, a female, aged 42, died at 32, Great Marlborough Street. I learned from the persons with whom she lived that she habitually drank pump water, but did not get it from the pump opposite. She had it principally from Broad Street, but occasionally from Vigo Street. There were three deaths at 7, Great Marlborough Street, on the 2nd, 3rd, and 5th of September. This house is rather nearer to two other pumps than to the one in Broad Street, but water had been fetched from the latter pump, and had been drank at dinner for a fortnight previous to the attacks of Cholera.

On the 1st of September, a girl, aged 8 years, died at 29, Carnaby Street. On calling a few days afterwards I was informed by other members of the family that they were in the habit of having water from Broad Street, and that deceased drank of it on the days preceding her illness. On the same day,

a female, aged 34, died at 31, Carnaby Street. I was informed, on making inquiry, that she used to send to Broad Street two or three times a-day for water to drink. On the 1st also, a female, aged 35, died at 40, Carnaby Street. I was informed that she sent nearly always to Broad Street for drinking water.

The houses in which the above three cases occurred are in that part of Carnaby Street which is near to the pump in Marlborough Street; and Tyler Street, in which the following cases occurred is also very near to the same pump.

Two widows who lived in the kitchen at No. 9, Tyler Street, were attacked with Cholera on the 2nd of September, and were taken to Middlesex Hospital, where they both died. The daughter of one of the deceased women, a girl aged 15, told me that she used to fetch water from Broad Street pump, as her mother did not like the water in Marlborough Street. Both the deceased persons used to drink the water up to the time of their illness. My informant also drank of it; she had a Diarrhœa, but was not seriously ill. On the 2nd of September, a man and his wife died of Cholera at 8, Tyler Street. The landlord of the house made an inquiry of the grown-up children of the deceased persons for me, and I learned that they used to have water from the pump in Broad Street, as they considered the water in Marlborough Street not fit to drink.

On the 1st of September, a tailor, aged 50, and

his son, aged 12, died of Cholera, at 10, Cross Street, and within three days afterwards four more of his children died, two of them being grown up. This family were great drinkers of pump water, and used to send for it every day, but more especially to drink during the night, as they were thirsty in the warm weather, owing to the great number sleeping in one room. The children fetched the water from various pumps, but frequently from Broad Street. On the 2nd of September, a boy, aged 7 years, died at 4, Cross Street. This family sent frequently for pump water, both to Broad Street and Warwick Street.

On the 2nd of September, a carpenter, aged 30, died at 7, Upper John Street, Golden Square. He was a foreigner, and used to drink wine and water to his dinner. The water was procured by the people who kept the house, and they got it from Broad Street pump, as they thought the water better than that in Warwick Street, which is much nearer. Two other persons, who also drank the water, were taken ill at the same time as deceased, but recovered. One was the servant of the house, and the other was a young man in the family. My informants were the widow of the deceased man and the sister of the young man who recovered. It is worthy of notice, that the servant had an attack of Cholera a fortnight previous to the last one.

A girl, aged 5 years, died at 42, Ham Yard, on the 8th of September, having been attacked with

Cholera on September the 2nd. Deceased went to school in Dufour's Place, and a brother, a little older than herself, told me in the presence of his mother that he had seen his sister drink the water from the ladle at the pump in Broad Street. A girl, aged 7 years, at 3, Angel Court, Great Windmill Street, was attacked with Cholera on the 1st of September, and died on the 8th. She also went to school in Dufour's Place, and her parents think it probable that she drank the water of Broad Street pump. A boy, aged 9 years, died on the 2nd of September, at 9, Great Crown Court. He went to school near the pump in Broad Street, and was in the habit of drinking a good deal of the water.

At 13, Wardour Street, near to Oxford Street, the wife of a tradesman died on the 2nd of September. Her husband informed me that they used to have pump water which deceased used to drink. The boy was always directed to fetch it from Broad Street. The son of a chemist at 115, Wardour Street, which is about a dozen doors from Oxford Street, was attacked with Cholera, and went to Willesden, where he died on the 2nd or 3rd of September. He dined on the days preceding his attack at some dining-rooms in Wardour Street, where the water from Broad Street pump always stood on the table. He drank malt liquor with his dinner, but frequently took some water with the pastry or sweet pudding with which he concluded it. His father was my informant.

The wife of a tailor at 2, Great Chapel Street, Soho, was attacked with Cholera on the 4th, and died on the 8th of September. I was informed by the person with whom she lodged, that she was a great drinker of pump water, and that she used to drink a good deal of cold water at the Baths and Wash-houses in Dufour's Place, where she had been at work on the days preceding her illness. On going to the Wash-houses I learned that some persons drank the water of the cistern there, and others that of the Broad Street pump. The child of this woman was attacked on the 7th, and died on the 11th of September.

There were three deaths at 14, Noel Street; two on the 1st of September, after a few hours' illness, and one on the 6th, after an illness of four days. Pump water was constantly drunk in this house. I saw the boy who fetched it in the presence of the family. He generally got it from Berner's Street, or Newman Street, but had occasionally obtained it from Broad Street, and had done so about two months before my inquiry, which was made at the end of October, but he could not remember the day or week when he last obtained it from Broad Street.

A young woman died at 39, Rupert Street, on the 5th of September, but she was taken ill in St. Anne's Court, where three other members of her family died. She was about to call in Rupert Street, but dropped down at the door; she was carried into the house, where she expired.

On the 10th of September, a girl, aged eight years, died of Cholera after an illness of three days, at 7, Naylor's Yard, Silver Street; she went to the National School facing the end of Broad Street, and used to drink the water.

There were four fatal attacks of Cholera at No. 1, Brewer Street, in the beginning of September. One of the deceased persons was the master of the house, who used to send constantly to Broad Street for drinking water, and the others who were attacked, were also in the habit of drinking it.

A cabinet-maker, who was removed from Philips' Court, Noel Street, to Middlesex Hospital, worked in Broad Street. A boy also who died in Noel Street went to the National School at the end of Broad Street, and having to pass the pump probably drank of the water.

A tailor who died at 6, Heddon Court, Regent Street, spent most of his time in Broad Street. A woman removed to the hospital from 10, Heddon Court, had been nursing a person who died of Cholera in Marshall Street.

There were eight fatal attacks at a considerable distance from the pump in Broad Street, but within the external boundary marked on the map, respecting which, I did not, on inquiry, trace any connection with the water of that pump.

Of the above 48 persons, it will be observed that 28 were ascertained to have drunk the water of Broad Street pump shortly before they were at-

tacked, whilst there is a greater or less probability that 10 of the others also drank it, and 2 more had been exposed to the malady, by residing in the same room with a patient who died of it. As regards the 8 cases in which I could trace no connection with the water of the pump in Broad Street, it may be observed that they form but a slight mortality for the large area in which they happened; a mortality not greater than was occurring in surrounding parishes, and probably not greater than would have taken place in this district if the great outbreak had not occurred.

I ought to mention, that in all the cases I have alluded to throughout the Report, the water from Broad Street was drunk cold, without having been boiled. It is the custom in this district, as elsewhere, always to use the cistern water for making tea, and other purposes where heat is employed, and to send for pump water only for the purpose of drinking it cold*.

The following Table exhibits the chronological features of this terrible outbreak of Cholera:—

* I should like to mention here, a fact that I met with in making a part of the house-to-house inquiry, which the Committee undertook in the winter. Out of the 14 houses in Cambridge Street, there were four in which I was distinctly told that none of the inmates ever sent to Broad Street for water, and that they did not do so in August last. There was no case of Cholera in any of these houses. In the other 10 houses, the water from the pump in Broad Street was more or less used by the inmates last August, and there was Cholera in all of them but one, and in that house there was Diarrhœa.—*J. S.*, June 14, 1855.

Date.		No. of Fatal Attacks.	Deaths.
August	19	1	1
,,	20	1	0
,,	21	1	2
,,	22	0	0
,,	23	1	0
,,	24	1	2
,,	25	0	0
,,	26	1	0
,,	27	1	1
,,	28	1	0
,,	29	1	1
,,	30	8	2
,,	31	56	3
September	1	143	70
,,	2	116	127
,,	3	54	76
,,	4	46	71
,,	5	36	45
,,	6	20	37
,,	7	28	32
,,	8	12	30
,,	9	11	24
,,	10	5	18
,,	11	5	15
,,	12	1	6
,,	13	3	13
,,	14	0	6
,,	15	1	8
,,	16	4	6
,,	17	2	5
,,	18	3	2
,,	19	0	3
,,	20	0	0
,,	21	2	0
,,	22	1	2
,,	23	1	3
,,	24	1	0
,,	25	1	0
,,	26	1	2
,,	27	1	0
,,	28	0	2
,,	29	0	1
,,	30	0	0
Date unknown		45	0
	Total	616	616

The deaths in the above Table are compiled from the sources mentioned in describing the map; but some deaths which were omitted from the map, on account of the numbers of the houses not being known, are included in the Table. As regards the date of attack, I was able to obtain it with great precision, through the kindness of Mr. Sibley, in upwards of 80 deaths which occurred in Middlesex Hospital; for the hour of admission was entered in the hospital books, as well as the previous duration of the illness. In a few other cases also I had exact information of the hour of attack; and in the remainder I have calculated the date of attack by subtracting the duration of the illness from the date of death. There are 45 cases in which the duration of the illness was not certified to the registrars, and where I had no means of ascertaining it. The time of attack in these cases is consequently unknown. These persons nearly all died on the first days of September, in the height of the calamity; and it is almost certain that they were cut off very quickly, like the others who died at this time.

It will be observed that the daily number of fatal attacks was already much diminished by September the 8th, the day when the handle of the pump in Broad Street was removed; and it is not improbable that the water had, from some cause or other, ceased to contain the cholera poison. At all events, the few attacks which took place after

September the 10th or 12th must have been occasioned in the usual manner, and not through the medium of the water.

I wish it to be understood that I do not attribute every case of Cholera to the use of polluted water. It is my opinion that every case is caused by swallowing the peculiar poison or morbid matter of Cholera, which has proceeded from a previous patient sick of the same malady; but this morbid matter need not be in water, and there are facilities for its being accidentally swallowed, and propagating the disease, without the aid of water. This is more especially the case in the crowded dwellings of the poor, where a number of persons live, sleep, cook, and eat in one room. I do not, therefore, attribute every case of Cholera in the parish to the water of the pump well in Broad Street, but certainly those which constitute the great outbreak which took place at the end of August, and which suddenly raised the mortality of this disease from about five in a week to nearly 500.

The reason why the water of this pump produced the great outbreak is, I feel confident, that the evacuations of one or more Cholera patients found their way, by some means, into the well. There were fatal cases of Cholera, a few days before the great outbreak, not far from the well, and there may have been other cases, not fatal, which are not recorded.

I published several instances, in 1849, of sudden

and severe outbreaks of Cholera arising from the pollution of tanks, wells, and other local supplies of water, by the contents of cesspools and house-drains. In the outbreak at Albion Terrace, Wandsworth Road, in that year, the night soil was from six to nine inches deep at the bottom of the tanks that were examined. In some instances, in Horsleydown and Rotherhithe, the contamination of the water was equally well proved. In these instances, the dejections of a patient ill of Cholera entered the water before the great outbreak.

I have been making inquiries during the autumn just passed, in the South districts of London, which shew that the dejections of Cholera can reproduce the disease after passing down the sewers into the Thames, and being afterwards distributed through some miles of the pipes of a water company. Under these circumstances, the cases of Cholera are scattered over the whole of the districts supplied by the company; and become gradually more numerous, as each set of cases, the dejections of which pass into the river, produces new ones. In the instances, on the other hand, in which a pump well, or some other local supply of water is thus contaminated, the outbreak is always sudden and violent.

JOHN SNOW, M.D.

12*th December*, 1854.

MR WHITEHEAD'S REPORT

OF HIS

SPECIAL INVESTIGATION OF BROAD STREET.

THIS investigation has been attended with some difficulty, for two reasons.

1. Because of the shifting of the population.

I have reason to believe that at one time since the pestilence the street did not contain one half, possibly little more than a third, of its usual number of inhabitants. At least it is certain that only twelve of its families in which deaths from Cholera occurred now reside where they did at the beginning of September 1854, no less than seven of the twelve being detained there as householders or shopkeepers. It is not a little strange that very many who have thus migrated have not deemed it necessary to remove out of the infected district, in some instances selecting for their new abodes houses as severely visited as those whence they

came. I find however that a feeling of uneasy apprehension respecting the approach of summer is beginning to prevail even among those who have hitherto stood firm. Whenever the Cholera shall reappear in the country I have no doubt that this neighbourhood will be deserted by all who can conveniently depart, unless there shall previously have been given a satisfactory account of the causes of the late calamity and a reasonable prospect held out of comparative immunity for the future. With regard to those who have moved away, I have in many cases traced them out and personally visited them, sometimes following them to a considerable distance.

2. The other difficulty has arisen out of the very nature of the investigation. It has grown upon me as I proceeded. I have often had to return as many as four or five times to the same families to put questions which I did not at first see the necessity of asking. Indeed, throughout the whole street I have gone over the same ground again and again, in order to bring each portion of the evidence up to the proper standard of accuracy and reliability.

The statistics which I shall lay before the Committee are the result of personal inquiry.

No. of Houses (exclusive of the Brewery) 49.		
Resident Householders (August 1854) ... 35.		
Floor.	Resident Population. (Aug. 1854.)	Deaths of Residents. (Cholera.)
4th Floor ..(In 2 Houses only)	6	0
3rd ,, (2 Houses have no 3rd)	224	22
2nd ,, ...	235	18
1st ,, ...	212	23
Ground (33 occupied as Dwellings) ...	138	17
Kitchens (19 inhabited)	68	6
Cottages (5 in number)	13	4
	896	90
	North South	North South
	470 426	39 51

Besides the 90 deaths here mentioned, there were 28 among persons employed in the factories and workshops of this street, but residing elsewhere.

Twelve houses only were free from death (of residents or non-resident workpeople)—*i. e.* eleven on the North side (in two of which however there were recoveries from collapse) and one on the South side.

The next Table gives the number of fatal cases, with date of attack.

Date of Attack.	No. of Fatal Attacks.
August 12th ...	1
,, 28th ...	1
,, 30th ...	1
,, 31st ..	6
September 1st ...	26
,, 2nd ...	24
,, 3rd ...	9
,, 4th ...	8
,, 5th ...	6
,, 6th ...	5
,, 7th ...	0
,, 8th ...	2
,, 9th ...	1
	90

The 28 non-residents were all seized during the first two or three days of the outburst. The factories and workshops which suffered were all closed for a time after Saturday evening, Sept. 2nd.

The Committee are well aware that these Tables are compiled from papers containing the details of individual cases, which circumstance I only mention for the satisfaction of others into whose hands the Report may fall.

I am acquainted with the name, and have ascertained, as far as possible, the age, of each deceased person, together with the alleged precise hour of attack, position of the room occupied, and general sanitary condition of the house.

If I now confine myself mainly to one point, it is because I have been compelled by the evidence to recognise its primary importance.

Among the questions which the Committee decided should be asked throughout the district was one relating to the use of drinking-water by the inhabitants. I soon found that the Grand Junction and New River Companies divide Broad Street, and indeed the whole district, in such a way as utterly to preclude the notion of either of them being at all accountable for the outburst. It took place simultaneously in both their districts. Moreover, a careful examination has fully satisfied me that, as a matter of fact, they must be held free from suspicion on this particular point. The only other water used for drinking to any extent by the people of the infected streets was that of the parish pump in Broad Street. I should have much preferred not to anticipate the conclusion to which my evidence points, but for the sake of clearness I find it necessary to state my conviction, slowly and I may add reluctantly adopted, that the use of this water was connected with the commencement and continuance of the outburst in a very remarkable way. No one actively engaged on the spot during the pestilence will or can mistake what I mean by the outburst. There was Cholera in the district before it began. There was Cholera in the same district after it was over. And yet its limits both of time and place are so marked, that any one resolved to carry out an inquiry on strictly inductive principles may feel himself no way perplexed, or even concerned, with

hypotheses either connecting or disconnecting it with previous cases. If such questions should ultimately come to be discussed by the Committee, it must at least be distinctly understood that my investigation has been conducted without any reference to them whatever.

In all cases, unless the contrary be expressly stated, it must be borne in mind that the use of *cold* water is meant. Indeed, it may almost be taken as a rule that the water used for boiling was the Company's, or, as I shall generally term it, the Cistern water.

I shall first deal with the 90 above-mentioned fatal cases.

With respect to the first case, which commenced on the 12th of August and lasted 35 hours, I can learn nothing concerning the use of water.

The next (August 28th) was the case of an infant, whose mother emphatically denies that it ever tasted of the pump water, assigning as a reason a decided objection to this water on the part of her husband, who was himself fatally seized with Cholera on the 8th of September, being almost the last person who was attacked, either fatally or not, in this street. He of course was no drinker of the pump water. And I may here add that a like positive denial upon this point is given, by persons competent to decide, both in the other case marked September 8th and in that of September 9th.

The third fatal attack in Broad Street, that of August 30th, was the case of a lad who went to Bayswater on Saturday August 26th, returning Monday the 28th. The family with whom he resided in Broad Street are positive in their assertion that he never drank of the pump water. The precise hour of his attack was 5 A.M. At noon, the same day, he was sent back to Bayswater. It is worthy of notice that his mother and sister (at Bayswater) were also seized the following evening and died before the end of the week.

There remain then to be considered the cases of those who were fatally seized on and after Thursday August 31st down to September 6th (inclusive).

Of these there are 15 concerning whom I cannot learn anything bearing upon the point in question, either because the deceased were isolated persons of whose habit in this matter no one can speak with certainty, or because surviving friends and relations who might testify are now out of reach, or in some few instances, and I am happy to say very few, because those who could settle the point refuse to give any information.

Respecting 8 others of the cases now under consideration the evidence is more or less strong against the probability of the deceased having drunk of the pump water previous to illness.

I have marked 6 more as *doubtful*, who, according to the testimony of surviving relatives, may, or may not, have drunk of this water.

Next I have set down 10 cases of persons who,

there is every reason to believe from all I can gather, did use it, but whom, inasmuch as it is not a matter of absolute certainty, I have distinguished from the remaining 45, who, I could prove to demonstration, did drink of it between the afternoon of Wednesday (August 30th) and the hour of attack.

For facility of reference, these figures are set side by side in the following Table:—

Date of Attack.	Whether drank the Pump Water shortly before illness.					Total.
	Decidedly.	Probably.	Not known.	Doubtful.	No.	
Before August 31st	...	...	1	...	†2	3
August 31st (Noon) to September 6 (inclusive)	*45	10	15	6	†8	84
After September 6th	...	...	...	...	†3	3

One fact relative to the above details is noticeable, *viz.*—that of the 56 fatal attacks assigned to the first three days of the outburst (August 31st, September 1st, and 2nd) it is only affirmed respecting two, with any semblance of certainty, that they did not use the pump water. I do not mean that all the other 54 *did;* but that only 2, according to positive testimony, *did not.*

Of the 28 deaths of non-resident workpeople, 24 were of persons employed at two factories, where, as I am informed by the proprietors, the water from the pump was in constant use for

drinking. All the 24 were seized during the first three days.

Concerning three of the other four I know nothing more than that they were taken ill during the same period.

The other was a young man who drank this water daily. He went home as usual on Friday evening, September 1st, and was attacked the next day. The landlady of the house where he worked affirms that he was the only person in the house who drank this water, and the only one who was at all ill.

Whilst prosecuting these inquiries I soon perceived the desirableness, and indeed the necessity, of closely examining those who had recovered from attacks, whether of Cholera or Diarrhœa. I shall not pretend to distinguish between Cholera and Diarrhœa. I can at least assert that the great majority of those to which I shall refer were very serious cases.

I find then that of 50 residents who thus recovered,

4 are now beyond the reach of inquiry.
2 give uncertain accounts of themselves.
†7 affirm that they did not drink the pump water.
2 probably did drink it.
*35 certainly did drink it between August 30th
— and their attack.
50

In addition to which number a family of 8, who told me that they habitually used the pump water, suffered a good deal of illness, all being more or less severely, but in no case fatally, attacked with Diarrhœa.

Of these 50 persons, 34 were seized during the first three days of the pestilence. The last attack of these cases, apparently connected with the pump, was on September 6th. It seems that there was little even of Diarrhœa in this street after that date.

In the meantime I had advanced a step further in my views as to what constituted a proper inquiry into such a subject, having come to the conclusion that I must likewise examine, upon this matter, as many as possible of those who, being resident in Broad Street at the beginning of September, did not suffer at all either from Cholera or Diarrhœa. The brief and summary aspect of the following Tables will convey but an inadequate idea of the pains taken to elicit and test the information they contain :—

Residents who did not drink the Pump Water in the last week of August, or the first week of September, and were not ill.	
As affirmed by themselves, or by members of their respective families	243
As affirmed by others who claim to have full knowledge of their habit in this respect.....	36
	279

I have a record of the names and abodes of all these persons.

I also made diligent search for those residents who, at the time alluded to, drank the water with impunity. I give the result of this inquiry without attempting, as in several instances I might, to lessen its force by any qualifying statements:—

Drank the Pump Water with impunity.		
Daily.....	According to usual custom	28
From August 30th, noon, to September 2nd, P.M.	In most cases occasionally	15
September 3rd, A.M., and after	Ditto	14
		57

Uncertain and contradictory accounts given by	(no illness)	9
Drank it once boiled . .	(no illness)	1
Sometimes used it, but often went weeks without any . .	(no illness)	2
Drank a good deal of it, when ill from another cause than Cholera		1

I have thus inquired, or at least attempted to inquire, concerning 497 of 896 persons resident in Broad Street at the time of the pestilence. I need scarcely insist upon the peculiarly advantageous circumstances under which the inves-

tigation has been conducted. Long before the Cholera came upon us I was well acquainted with the street and its inhabitants. It so happened that during the outburst I was more in this street than in any other, visiting very many of the families which suffered. Soon afterwards I collected, of my own accord, full statistical information throughout the whole of St. Luke's district parish. So that when the Committee desired me to examine more particularly into Broad Street, I had but to inquire again respecting a matter with which I was already tolerably familiar. The ordinary course of my duties taking me almost daily into the street, I was under no necessity to be either hasty or intrusive, but asked the needful questions just when and where opportunity occurred, making a point of letting scarcely a day pass without acquiring some information, and not caring how often I had to verify it in quarters where I could rely upon a willingness to converse upon the subject.

It appears then that, among the drinkers of the pump water, the ratio of those attacked to those who escaped is at least 80 to 57, whilst the corresponding ratio among non-drinkers of that water is but as 20 to 279.

Or, to state the case in another way, among those attacked the ratio of pump water drinkers to non-drinkers of the same water is 80 to 20, whilst

among those who escaped the corresponding ratio is but 57 to 279.

The latter ratio (57 to 279) is at once apparent to the reader from the two Tables immediately preceding. The other (80 to 20) is reckoned from those figures to which * or † were prefixed.

I apprehend that these figures afford a reasonable ground for believing that the pump, in some way or other, was instrumental, to say the very least, in aggravating the disease.

The following circumstances strengthen this belief :—

1. On the north side of the street stand two establishments next door to each other, each employing from 30 to 40 persons in workshops at the rear. From the one there were seven deaths by Cholera. From the other none. To the former a supply of water from the pump was fetched daily for such as might desire to drink it. At the latter no water but the Company's was ever drunk. An additional contrast to the rate of mortality at the former is presented by the fact of its proprietor, with his family and servants (10 persons in all), entirely escaping the disease, though they resided in the house which forms the front of the premises. He assures me that none of the inhabitants of this house used the pump water.

2. On the south side of the street, at no great distance from one another, stand two larger esta-

blishments, a factory and a brewery. From the former, where water from the pump, which is close at hand, stood constantly ready for the casual drinking of the workpeople, 18 out of 200 were fatally attacked in rapid succession. Of 70 men employed at the brewery not one died and only two were at all ill. Not many of these men drink water at all. At least it is certain that they never sent from the brewery to the street pump. Here again a double contrast may be perceived by comparing the brewery, not only with the factory, but with the then unfinished block of model-houses now known as Ingestre Buildings. A narrow court separates these buildings from the brewery. Several of the men employed on the buildings were fatally seized in such quick succession that the works had to be stopped. The works having been completed and the men dispersed by the time I was desirous of inquiring more particularly concerning the deceased workmen, I caused a paper of questions to be forwarded to the foreman, who sent me word in writing, that seven of his thirty-five men died from Cholera, that the first was attacked September 1st, that the works were discontinued during Monday September 4th, that those who died had drunk of the pump water, and that he had not heard any of the others say whether or no they drank it with impunity. Ingestre Buildings do not belong to Broad Street, and I should not have referred to them but for their proximity to

the brewery and their marked contrast to it in the matter alluded to.

3. The subjoined Table may also throw some light upon this question. I have denoted the houses by letters of the alphabet, rather than by their respective numbers. Should any one, however, who is scientifically and experimentally interested in the investigation desire to examine into the authenticity and correctness of my statements, I shall be most happy to submit to his inspection all the documents which I have prepared for my own guidance.

Houses in which no one was attacked.				
Houses.	Population.	How many used, or did not use, the Pump Water, August 30th to September 8th.		
		No.	Yes.	Remarks on the Use of the Water.
A ...	11	11		
B ...	9	4	5	Sept. 4th, for the first time.
C ...	10	10		
D ...	13	13		
E ...	21	19	2	Sept. 2nd and then not much.
F ...	5	3	2	Cold with Brandy.
G ...	6	6		
H ...	13	13		
I ...	6	5	1	Doubtful.
J ...	3	3		
10	97	87	10	

In No. F, the landlord and his wife used to draw the water from a filter, which would sometimes stand several days without replenishing. Mrs. —— tells me they began to have it straight from the pump

as soon as they perceived the Cholera got bad, which, at the earliest, could have been but September 1st.

4. One house, in which a very remarkable recovery from collapse took place, contained at that time but two permanent residents, *i. e.* two only who slept there throughout the pestilence. They were the two servants of a gentleman who was absent during the greater part of the time. One of these servants was seized badly September 1st, 8 A.M. She soon became completely collapsed, but ultimately rallied and passed safely through a most dangerous fever, being carefully nursed throughout by her fellow servant. I visited her daily, and can myself testify to the fact which, so far from keeping in the back ground, I am anxious to state plainly and unequivocally, that she drank the pump water incessantly and abundantly during her illness. I could mention many other instances to the same effect. One lad who recovered from a serious attack drank 10 quarts of it on Sunday, September 3rd—whilst a girl whose recovery from collapse seemed little less than miraculous drank 17 quarts of it the same day, September 3rd. I take this opportunity of recording that the pump water was very generally, indeed almost universally, administered, during the period of illness, both to those who recovered and to those who died. With respect to the servant above-mentioned, it is certain that she was in the habit of drinking a

great deal of the water every day previous to, and down to the very day of, her being seized. Her fellow servant, who escaped entirely, only commenced to drink it September 2nd, and then in no great quantity, and with brandy (cold). Their master drank a very little of it September 2nd, but says that he thought it very offensive.

5. In another house, in which no one died, there were, to a population of 26, three recoveries from collapse, two being in the same family. This family, seven in number, used the pump water every day at dinner, three pints to the seven persons, of whom five were not attacked. The two lads attacked were seized, one August 31st, 2 P.M., the other September 6th, 8 A.M. The third case in this house was of a foreigner, seized September 1st, 10 A.M., who also was a drinker of the pump water. I made inquiries of the other residents in the house, and found only one other person who drank this water either at that or any other time. He drank it with impunity. I found that 14 of the rest neither used to, nor did at that time, drink it. They none of them suffered. Of the remaining three I could learn nothing. Among the 14 was a family, six in number, who a few years back were in the habit of using it, but the father having once looked down the well, when it was opened for some purpose or other, perceiving how near the water was to the surface, concluded that its sources

of supply could be none of the purest, and so forbade any further use of it.

I may here mention, by way of illustrating the imperative need of care and discrimination in investigations of this kind, that my first inquiries led me to record that the pump water was in general use throughout both these houses. It was only when I had gradually become impressed with the necessity of subjecting both individuals and families to a more particular examination, that I elicited the facts as I have now given them. I know that I have used the utmost impartiality in these examinations, sometimes convicting, if I may use the expression, persons of having drunk the pump water with impunity. But I must say that, in the very great majority of instances, additional evidence reveals facts tending to implicate the pump. Indeed, nothing has more conduced to the decided opinion I now hold upon the subject than the gradual disclosure of important testimony, often directly opposed to that which was first given.

Lest, however, any should imagine that I have from the first been concerned only to establish a preconceived notion, I think it right to make known that when I first heard of the outbreak being attributed to the pump, I stated to a medical friend, in a conversation which he well remembers, my belief that a careful investigation would disprove that theory, basing my idea of its in-

accuracy upon the fact already mentioned, and of well known to me, of several recoveries from complete collapse taking place, at least in spite of, if not actually by reason of, its constant use. Moreover, in a letter to the propounder of this theory, acknowledging the receipt of a copy of his book on Cholera, whilst admitting that his hypothesis afforded an ingenious and plausible explanation of the phenomena, I started an objection to his views on the propagation of the disease so far as they applied to this particular outburst. I shall presently refer to this objection, with intent to invest it with all the force to which it is entitled from the facts which have come under my notice.

In the meantime I resume the detail of circumstances which tend to strengthen the suspicion against the pump.

6. A gentleman, who, with his two brothers, is brought daily by his business into Broad Street, informs me that his mother, who resided at Hampstead (West End), being very partial to this particular water, was in the habit of drinking it daily, having it fetched in a bottle by a cart that went every day from Broad Street to Hampstead. She was seized with Cholera on Friday (September 1st) and died the next day. A lady staying with her at the time also drank of it and died. A servant drank the water and had a slight attack of Diarrhœa. The accuracy of this state-

ment has been called in question. A lady, who, having herself drunk the water without ill effect, was disposed to doubt its connection with Cholera, told me that she had heard that the person whose duty it was to take this daily supply to Hampstead, had in fact been in the habit of fetching it from some locality in Hampstead, in order to save himself trouble. I therefore returned to the son of the deceased lady, and stated this to him, reminding him of the extreme importance of accuracy in such a matter. He most positively repeated his assertion that the water was actually taken from this pump, and that as far as trouble was concerned, it was less trouble to take this water than it would have been to procure any other, as the daily starting-place of the cart is situated not twenty yards from the pump. He further informed me that one of his brothers who was in the habit of drinking this water suffered from Diarrhœa, whilst he himself and his other brother did not drink it and were not ill.

7. In a house, where I am well known, circumstances enabled me to collect together in one room several mothers of families, with whom I held conversation at some length relative to the habit of the inmates in respect of the water used for drinking. This method possessed the obvious advantage of their assisting and correcting each other's evidence. In this house there were, to a population of 32, the three following deaths from Cholera.

Deceased persons.	Age.	Date of Attaek.	Date of Death.
Mr. ——— ...	38	31st Aug., noon	1st Sept., 1 A.M.
Mr. ——— ...	35	2nd Sept., 8 A.M.	15th Sept. (fever).
A boy	8½	2nd Sept., 9 A.M.	3rd Sep., 4.30 A.M.

In the first two of these cases the drinking of the pump water previous to illness is beyond a doubt. I have set them down rather conspicuously, as I wish to call attention to a circumstance which, whilst it testifies to the reality of my own gradually-formed convictions concerning the pump, adds considerable weight to the reasons upon which they are based. By some mistake I had at first assigned a wrong date of attack to the two first of these cases, *viz.*— September 5th to the first, and September 8th to the second. The two widows having removed, I was led astray by a miscalculation on the part of a person still in the house. Neither did I detect the error by my own recollection, not having visited the house during the outburst. As my informant seemed positive in asserting that both the deceased were habitual drinkers of the pump water, I made a note (which I can produce) of the second case as being "a difficulty of the pump "theory, for why, if indeed deceased regularly "used its water, and was plainly susceptible of "Cholera, had he not been attacked earlier?"

When however I came, in due course, to seek out the widows, I at once discovered my mistake. With reference to the first case, the widow told me that her husband invariably drank the pump water before going to bed, sometimes to the amount of a quart, and that he certainly did drink it Wednesday evening, August 30th. She thinks that she herself did drink a little of it the same day (August 30th) but is sure she drank none afterwards. A surviving child of hers, age 11, told me that he drank about half a pint from the ladle (attached to the pump) August 31st, 8 P.M. and was none the worse for it. Another boy (the third fatal case above mentioned) is very likely to have done so. She sent her children out of the district September 1st, 8 A.M. The other widow used to drink beer for dinner whereas her husband drank the pump water. Respecting the other inmates of the house, the family of eight to whom I have before alluded were among the number; of the rest I ascertained, during the above-mentioned conversation, that 14 persons who were not attacked never used the pump water. About the four others I know nothing.

8. In another house where I had a similar opportunity of examining the remaining inmates collectively, I found that 20 out of 30 who resided there at the beginning of September never used the pump water, most of them giving their reasons for not doing so. None of these 20 suffered.

Concerning six others I could learn nothing, as they were gone away. Of the other four, two died of Cholera who were plainly shewn to have drunk this water shortly previous to being attacked. The remaining two (father and daughter) recovered from Diarrhœa. The mother at first told me that none of her family ever had water from the pump. On her mentioning my question afterwards to her daughter, the latter recollected that she did drink it and gave a reason for having done so. The father says he did not drink it.

9. There is a family, twelve in number, in this street, of whom two only were attacked,—two boys, who recovered. The parents informed me that they never used the pump water, and that they had forbidden their children to drink it from the ladle. On my questioning the children as to their obedience in this matter, it turned out that the two who were ill had drunk it in this way within forty-eight hours of being seized, and that none of the others had. It was fetched for them during their illness, and their mother began drinking it Sunday evening, September 3rd, without ill effect.

I have throughout been careful to bear in mind this general use of the pump water during the period of illness, always asking the surviving relatives whether it was not likely that they themselves took this opportunity of drinking it, and especially taking pains to distinguish between its

use by the sufferers before and after the hour of attack.

10. In the next house to that in which this family lived, resided a young couple of which the husband was seized, 1st September, 9 A.M., and died the same day at 12 P.M. His wife, though she nursed him, escaped. She at first told me that he never drank water from the pump, but afterwards recollected that, quite contrary to his usual custom, he desired her to fetch some for dinner on Wednesday, August 30th, of which she was sure that she did not partake. This case is interesting as shewing, if indeed the pump were in fault, that the interval between the drinking of the water and the attack was in one instance about forty-four hours.

11. Just opposite to the pump, on the North side of the street, lived a family of five persons, four of whom (mother, father, and two grown-up daughters) were, with distressing rapidity, swept away by the pestilence. They were all drinkers of the pump water, including the one survivor, a lad, who certainly drank some, though but a little, August 31st, but was away the greater part of the following days.

12. In a family of four, the father was fatally seized 1st September, 11 A.M.; a son, not fatally, 2nd September, 5A.M. ; another son, fatally, 6th September, 8 A.M. The mother alone was not attacked. She is sure she never drank the pump water. She is equally sure that her husband and the son who

was first seized did drink it. She is not so sure about the other son.

13. Two sons, from a family of seven, are known to have drunk the pump water from the ladle. One was fatally seized, the next day, with Cholera. The other had a not fatal attack of Diarrhœa. No other member of the family either drank this water or was ill.

14. In another family, a son, age six, was seized 2nd September, 6.30 P.M., and died 4th September, 11.15 A.M. The father was seized 5th September, 7.30 P.M., and died 6th September, 10.15 P.M. The mother and a female child escaped. The mother never drank the pump water. Her husband often did. She knows he did between September 1st and his illness. She thinks it likely the boy did drink it, because it was his practice to do so. The girl may, or may not, have drunk it.

15. The last instances of this kind of evidence which I shall adduce are the result of a series of investigations respecting the inmates of a single house. They are especially worthy of notice, not only as adding a striking confirmation of all that has been previously recorded, but as being a fair illustration of the manner in which the whole inquiry has been conducted, and as shewing very remarkably the utter worthlessness of hastily collected facts.

A father, mother, and grown-up daughter occupied the ground floor. The daughter was

attacked 2nd September, and died the same day. The mother assured me that they drank but little water, and that from the cistern. I then questioned her more particularly as to what they actually did drink on the 1st of September, when she said that she believed her husband and daughter had some gin and water after she was gone to bed, but added that the water was doubtless from the cistern. The husband was in the room during the conversation, but being very deaf could not hear it. I raised my voice and asked him whether he remembered having this gin and water? He did. Did he know where the water came from? From the pump. How did they take the water? He took it hot, and his daughter took it cold. Was he ill afterwards? No.

I next went to the top of the house where lived a family consisting of father, mother, a little girl about ten years old, and an infant. They had moved out of the district September 4th, but had recently returned. I asked whether any of them had been attacked with Cholera or Diarrhœa? No. Were they in the habit of using the pump water? Yes. Who fetched it? The little girl. Was she not afraid (I then asked the child), going through the streets to see the shutters all up and so many hearses about? Did'nt go through the streets. Why not? Was ill in bed with a cold. I asked the mother whether that was the case.

She then called to mind that it was so. Who fetched the water when the child was unable to go for it? Why then they got it from the cistern.

The adjoining rooms had been occupied at the time by a young couple, with infant child, and a female lodger. They were now gone away; but, as I knew that one or more of them had been attacked, I went after them, and found that the husband and lodger had both been seriously ill (collapse), but had recovered in different hospitals. The latter was the first attacked, 1st September, 1 P.M. The former was seized on the 2nd, but not collapsed till the 5th. His brother, who had spent the day (1st September) with him, was taken ill at his own home and died. Had they been in the habit, I asked, of drinking the pump water? No. When the young woman was attacked, what did the doctor recommend? Spring water. Where was it obtained? From the pump. When this water was in the house, did he drink of it? He then remembered that he did. Was it likely that his brother drank it? Very likely. Had the young woman taken any previous to her illness? He thought not; but as she was now in a situation in the suburbs he could not say. I then wrote the question with great distinctness on paper and desired him to put it to her the first opportunity. Some time afterwards I met him in Broad Street, when he told me he had put the question, and she

replied that she did drink it August 31st. I subsequently went again to their present lodgings, in order to inquire particularly of the wife, who had escaped entirely, whether she also might not have drunk the water at the same time. She very positively affirmed that neither she nor her child, which likewise escaped, drank any of it. She added that it is, and has long been, her practice to drink no water, without first boiling it.

Two women also died in the same house. One was attacked 3rd September, 9 A.M.; the other, 6th September, 4 P.M. Concerning the former and her habit as to drinking of water, no one could speak. The latter was described to me as a person not likely to have drunk water at all, a description which, however paradoxical it may seem, has in not a few instances supplied the clue which has led to clear discovery of the actual use of the pump water. I ascertained that she nursed the other woman and washed her things on the day previous to being herself seized.

With respect to the evidence of persons at that time drinking the pump water with impunity, I have already set it forth quite as strongly as I could. I have also mentioned instances of deaths from Cholera of persons who did not appear to have drunk this water previous to illness. Among the most noticeable of these is the case of a gentleman who was taken ill 1st September, at noon, and

died 17 hours afterwards. His daughter informed me that he never drank the pump water, whilst she herself and the shopman, being the only other inmates of the house, drank it daily. Neither must I omit to state that I have found four families, amongst whom the pump water was in constant use, more of whose members seem to have taken it with impunity than with ill effect, the proportion in each case being 3 to 1, 3 to 1, 5 to 2, and 5 to 1. I have not met with any family, of magnitude worth mentioning, who drank it *throughout* without ill effect to one or more of its members. There may be such instances. I only say I have not met with them. I have left nearly 400 of the then inhabitants of Broad Street unaccounted for. Possibly if I could have examined them all I might have discovered some striking exceptions. They may even yet be heard of. And I hope they will, if indeed there are such to be found, for there is nothing like sifting a matter of this sort to the very bottom. It is far too important a subject to be sacrificed to the symmetry of a theory.

I know a family of six who all drank it without injury at dinner, 3rd September, 3 P.M. The lad, a neighbour's son, who fetched it for them, was fatally seized that same evening, but he had drunk some the previous day.

Another family of five had it for dinner on the 4th and no harm followed.

It will probably be expected that I should state something about the sanitary condition of the houses. I feel bound to say that, as far as Broad Street is concerned, there is this connection between defective sanitary arrangements and the Cholera, that a house ill regulated in other respects is but little likely to have its receptacles for the Company's water well attended to. Without pointing, as I could, to individual instances of sad and culpable neglect, I shall content myself with saying that I well know that many of the unfortunate deceased were literally driven to resort to the pump through mistrust of the cistern. A constant supply from the main, with total abolition of cisterns, is an imperative necessity.

Here let me invite attention to the fact, apparent from the statistical table, that the population of the houses which escaped was decidedly below the average house population throughout the street. Upon which fact I have this remark to make, that the houses containing few persons are precisely those which, being for the most part the best regulated in all respects, are consequently the best regulated in respect of the cisterns. There is therefore the less, or rather no, need for the inmates to resort elsewhere for water. To which must be added that scantiness of population in particular houses is owing to the absence, often to the absolute exclusion, of children, whom I have found to be the general carriers of the pump

water, *i.e.*, wherever it is habitually used. And here I imagine is a reasonable account of the comparative immunity from Cholera, in this neighbourhood, of old, infirm and isolated persons;—they had no one to send for the pump water.

The subject of defective drainage ought perhaps not to be handled by any but practical men. As there is little need however of a special or technical education to render one sensible of grievously offensive stench, I may at least venture upon the assertion that I have long been aware from painful experience that many of the house drains in Broad Street are in a condition peremptorily demanding the attention of gentlemen professionally acquainted with such matters. And yet there does not seem to be any strong ground for believing that exhalations from house drains had overmuch to do with Cholera in Broad Street. I suppose it might reasonably be expected that, if such had been the case, the disease should have found an undue proportion of at least its earliest victims among the inhabitants of kitchens, or, as they might truly be termed, cellars. I have already shewn that the kitchen population of Broad Street was not quite decimated, whereas the population of the whole street was just more than decimated. But the manner in which the date of attack in each case bears upon the point is noticeable enough to deserve a full setting forth.

It will be observed that three women who died of Cholera in kitchens had recently washed Cholera linen, a fact to which I merely call attention, leaving it to others to connect it with the attack, or not, as they please.

Kitchen Population 68. Deaths 6.			
	Time of Attack.	Drank the Pump Water.	Remarks.
A Child .	2nd Sept. (slightly) .	Doubtful ...	Got worse Sept. 4th
A Boy ...	4th ,, 9 A.M ...	Yes.	
Mrs. —	4th ,, 1 P.M. ...	No	Had recently washed Cholera Linen.
Mrs. —	4th ,, 4 P.M. ...	Not ascertainable.	
Mrs. —	6th ,, 4 P.M. ...	No	Ditto.
Mrs. —	9th ,, Noon ...	No	Ditto.

Moreover, a child, living in a kitchen, was very severely attacked 2nd September, 7 A.M, but recovered. It is not certain, though by no means unlikely, that she drank of the pump water.—In another kitchen, a father and daughter were simultaneously seized, September 5th, and recovered. The daughter had used the pump water, the father not.—In another, a family who used the pump water suffered a good deal from Diarrhœa. I don't know the dates of attack.

Thus it appears that I only know of two attacks in kitchens in Broad Street during the first four days of the outburst, and of not one during the first two days.

There are questions relating to the duration of the pestilence and its probable connection with the pump which I must not omit to notice, though I do not find myself in a position to answer them satisfactorily. Upon hypothesis of this connection being made out, How long did the pump water continue to exert a deleterious influence? Had it gradually become thus noxious? Did it gradually cease to be so? I confess to considerable hesitation in attempting to answer these questions. Neither would I venture upon the subject at all but that I feel, if the hypothesis indeed be true, that it is a step in the right direction to make the attempt. I perceive that I am not in possession of sufficient data, which I regret the more as I also seem to perceive that if I had known from the first the right way to discharge the duty of a collector of facts these questions might have been well nigh settled.

Some facts, however, may be stated. The pump handle was taken off on Friday, September 8th. But by that time the epidemic had evidently subsided. Neither, as I have already stated, have I been able to trace any connection between the pump and the few attacks subsequent to Wednesday, 6th September, 8 A.M. It is rather strange that I have had to record that same date and hour of attack both in the last fatal case and also the last not-fatal case in which such connection is made out. There were but five fatal attacks in Broad

Street after that hour. I know of only two attacks not fatal in this street after that same hour; but as I have unavoidably left nearly 400 of the then inhabitants of the street unexamined, I cannot but admit that my records of Diarrhœa (not fatal) must be incomplete, as also the records of the use of pump water with impunity.

Whether then had the pump water become innocuous, or had it already swept off the majority of its drinkers, leaving unscathed just those of them who were not susceptible of its evil influence?

I must here for once transgress the rule I have observed of confining myself to Broad Street, and avail myself of a table, relating to duration of illness during the first five days, which I constructed several months ago from the Registrar's Returns for the account which I then wrote of the 376 deaths from Cholera which took place throughout St. Luke's district parish. This Table, however, is not complete, the duration of illness being in some cases omitted in the returns, and no returns for the first nine days of September appearing from one, at least, of the hospitals to which several of the patients were conveyed. The amount of incompleteness may be reckoned if I state that during the first five days of September the number of deaths in that district —a number, however, itself incomplete—were, on the 1st September 42, 2nd September 63, 3rd Sep-

tember 41, 4th September 43, 5th September 23. It must be noticed that the dates given below are of *deaths* and not of *attacks*.

TABLE OF DURATION OF ILLNESS.

Hours.	Sept. 1st. Deaths.	Hours.	Sept. 2nd. Deaths.	Hours.	Sept. 3rd. Deaths.	Hours.	Sept. 4th. Deaths.	Hours.	Sept. 5th. Deaths.
10&under..	10	10&under..	9	10&under..	1	10&under..	2	10&under..	4
10 to 20....	23	10 to 20....	23	10 to 20....	14	10 to 20....	11	10 to 20....	8
20 to 24....	3	20 to 30....	6	20 to 30....	8	20 to 30....	4	20 to 30....	2
Over 24....	1	30 to 40....	2	30 to 40....	1	30 to 40....	2	30 to 40....	0
		40 to 48....	7	40 to 50....	4	40 to 50....	3	40 to 50....	1
				50 to 80....	3	50 to 80....	3	50 to 80....	2
								80 to 100 ..	1

All that can be urged from this is that, supposing the number of rapid cases assigned to each day may be taken as an index to the malignancy of the cause, whatever that cause may have been, there was then a very perceptible decrease of malignancy after the cause had been in operation somewhat over forty-eight hours, followed, however, by no corresponding rate of diminution at least in the two last days here mentioned. Reference to the Table in which I gave the dates of fatal attacks in Broad Street points to a similar conclusion. And yet, as I have said, the mortality and even the illness, in this street, had subsided, almost to total disappearance, decidedly previous to the locking up of the pump. The second unmistakeable decrease of Cholera and Diarrhœa in Broad Street dates from Wednesday, September 6th, after 8 A.M.

Respecting the commencement of the outburst,

there is, of course, somewhat less of uncertainty in this matter. There was the case, already mentioned, of a man drinking the pump water only on Wednesday, 30th August, 1 P.M., who, although six persons were fatally seized on Thursday, August 31st, was not attacked till Friday, 1st September, 9 A.M. Thus we have, in one instance, an interval of 44 hours between the drinking of the water and the attack. I have reason to believe that this interval varied considerably in different cases. It is obvious that this varying interval renders it exceedingly difficult, if not impossible, to calculate either the time or the rate at which the water became free from pollution. The day of greatest pollution must have been August 31st.

I cannot help thinking that the decided diminution of fatal attacks on Sunday must have been owing to a partial purification (however effected) of the water on Saturday. Whether we are to infer from the above facts a returning impurity of the water acting on a diminished number of drinkers must remain an open question. Only I trust that no one will be for settling these questions by single instances. I myself drank a little of the pump water, with brandy (cold), with impunity on Sunday evening, at eleven o'clock. Whatever may have been the cause of the outburst, it will certainly be found that some, if not many, who were exposed to it did not suffer. If, for instance, it were atmospheric, it cannot be denied that we all breathed the air.

What then, after all, was the matter with the pump?

I did not consider that, so long as I was merely engaged in collecting facts, it was any business of mine to hazard even a conjecture upon this subject. But when the fact of a connection between the pump and the pestilence did appear to be established, I then thought it my duty no longer to keep that point in abeyance. The possibility of the water having been contaminated by matter thrown off from a Cholera patient who might, so to speak, have imported the disease from another locality, had often been discussed in committee, and it had been agreed that as yet no evidence had been discovered which would support such a supposition. There were, indeed, cases of Cholera, towards the latter end of August, in the upper part of Marshall Street, the sewer from which runs close by the pump well, but as it is a new sewer, built so recently as 1851, it was deemed very unlikely that it should be found to leak. Moreover, even if it did leak, and if one or two isolated cases had in this way polluted the pump water, why should the epidemic have so rapidly subsided when scores of subsequent cases, on the same line of sewer, must have added intensity to its cause? This was the objection which I had myself urged against such hypothesis. Neither was it thought at all probable, or possible, inasmuch as the house in Marshall Street is situated about fifty

yards from the pump, that percolation from a cesspool at such a distance would have taken place through the intervening ground, without all noxious particles being eliminated in the process of filtration. Similar objections held against the likelihood of contamination of the pump-well from the first case in Broad Street, the house where it occurred being nearly thirty yards from the pump. As I could ascertain little about this case, I took extra pains to inquire into what I then supposed to have been the only other case in the street previous to the great outburst. It was the one dated, in the second table, as commencing on Monday, 28th August, 5 A.M. I have before stated that the patient came from Bayswater, on Wednesday, August 30th, and so may have brought the disease with him. He was sent back to Bayswater seven hours after he was attacked. Having already calculated that the probable time when the pump water became sufficiently injurious to produce fatal effects was early in the afternoon of Wednesday, I examined into this case with considerable interest. I could elicit nothing, however, to distinguish it from the other early cases upon the point immediately in question. The house in which it occurred is more than thirty yards distant from the pump. At this time I supposed myself to know for certain that throughout the whole street there had been no other case before twelve o'clock on Thursday, August 31st. One of the earliest

cases on that day did indeed occur in the house which is the very closest of all to the pump, but it was not actually the earliest. Moreover the three first cases, in Broad Street, on that day, were so nearly simultaneous as to preclude the notion of their being otherwise connected with each other than as obviously having a common origin. One day last week, however, I happened to be studying the Registrar's Returns for a purpose unconnected with this matter, when my eye suddenly fell upon the following entry, in page 340:—

"At 40, Broad Street, 2nd September, a daughter, "aged five months, exhaustion, after an attack of "Diarrhœa four days previous to death."

I knew the case, and had recorded the date of death, but somehow had neglected to inquire about the date of attack, having passed it by lightly, I suppose, because it was the case of an infant. Neither had it occurred to me that the child might have been ill all the week. I immediately went to the house and ascertained from the mother, who occupied the back parlour, that the child was attacked on Monday, 28th August, and that the dejections at first were abundant, but ceased on Wednesday, 30th August. In answer to further questions, she told me that the dejections were collected in napkins, which, on being removed, were immediately steeped in pails, the water from which was poured partly into a sink in the back-yard, and partly into a cesspool in the front area.

April 3rd.

Being struck with the dangerous proximity of the cesspool to the pump well, I lost no time in communicating the facts to the Committee*, who ordered an investigation to be made forthwith. This investigation, carried out by our Secretary and Surveyor, is described elsewhere. It clearly established the general fact of percolation of fluid from the cesspool into the well. I do not pretend to any practical knowledge of such matters, but, having been down the well and examined the places where the steining was removed for the purpose of inspection, I can at least say that I saw enough to convince me on this point. The importance of this investigation, even apart from any consideration of Cholera, cannot be overrated. The sooner all shallow pump wells are filled up, and all house drains rigorously examined, the better.

As to whether any light be here thrown upon the propagation of Cholera, let every one form his own opinion.

In the same house where the above-mentioned infant died there were several cases of cholera. For the convenience of the reader I have fully recorded all the deaths which happened in this house in the following Table:—

* This was done on April 3rd, on which day also the substance of the preceding portion of this Report was for the first time laid before the Committee.

No. 40, BROAD STREET.					Whether or no drank the Pump Water previous to Illness.
Floor.	Age.		Date of Attack.	Date of Death.	
Back Parlour	6 mths	L. ...	28 Aug. 6 A.M.	2 Sep.	No.
1st Back ...	25 years	Mr. G.	31 Aug. 1 P.M.	2 Sep. 1 P.M	Yes.
3rd Back ...	25 do.	Mr. R.	1 Sep. 9 A.M.	18 Sep. in hospital	Yes.
Ditto ...	36 do.	Mrs. G.	4 Sep. 6 A.M.	5 Sep. 10 A.M.	Yes.
Back Parlour	49 do.	Mr. L	8 Sep.	19 Sep.	No.

The last and first cases are of father and child. It will be observed that, whereas the child was attacked 78 hours before the commencement of the general outburst, the father was not attacked till the day the pump was locked up. Nothing has been elicited to throw light upon the cause of attack in either case. What is more important, however, in reference to our present inquiry is this; if matter thrown off from the child and poured into the cesspool in the front area, during the early days of the week, percolated the ground and contaminated the well, why did the number of attacks so sensibly and rapidly diminish on Sunday, September 3rd, when matter from two adult cholera patients had been poured down the same place during the later days of the week? And why, moreover, did the epidemic so nearly disappear from Broad Street on or after September 6th, when another person was attacked in the same house September 4th? I have already said enough to shew that I am not in a position to answer these

questions. I might make some plausible suggestions; as for instance, that the drinkers of the pump water were not so numerous when so many who habitually used it were already dead—an allowable supposition, seeing that several hundreds were attacked in the first three days within 210 yards of the pump, and I have shewn how few habitual drinkers of its water among the inhabitants of Broad Street escaped. Again, on and after September 4th the residents were quitting the street in great numbers. Or it might be urged that the unusual drain upon the well, caused by the intense thirst of the sufferers, who, as I have said, were generally supplied with the pump water, might in some measure account for the rapid change in its quality. But as these suggestions are not conclusive to myself, I do not desire they should be so to any one else. For my own part I cannot state, from the facts before me, whether the water did actually get continually purer, or whether it first became purer and then got worse again.

Of one thing I am certain, that the case against the pump is strong enough to render wholly unnecessary, on the part of those who state it, any impatience at objections, however formidable they may appear. And I cannot but feel that, whatever uncertainty there may be about the nature of infantile diarrhœa, the plain fact of this child's dejections being poured into a cesspool (the connection between which and the pump well has been clearly esta-

blished) for a period of three days immediately preceding a great outburst, the phenomena of which point so decidedly to the pump as its origin, is indeed a very remarkable coincidence.

May 8th.

Since the above has been written I have called on Dr. Rogers of Berners Street, who attended the infant in 40, Broad Street, during its illness. He has very kindly furnished me with the following particulars respecting the case.

56, Berners Street,
May 30th, 1855.

Sir,

Being anxious to comply with your request, to give all the particulars I could remember of the illness of which Mrs. ———'s female infant died last September, and not having kept any notes of the case, I deemed it advisable, before doing so, to see the mother, and clear up some points of which my memory retained but an uncertain recollection.

The infant, the subject of your inquiry, was brought up by hand, or bottle, its mother, from ill health and want of milk, not being able to suckle it; it appeared to thrive better on its food (principally boiled ground rice and milk) than its brother who died two or three years ago, and whose history I will subsequently briefly refer to. It was born, I believe, in April '54, and was attacked with a Diarrhœa in the June following; its evacuations were pale and slimy, sour and offensive; it was under treatment for about five days; it continued pretty well till the 14th of August, when it had a similar attack, which however gave way to treatment in two or three days, but on the morning of Monday the 28th of August I was sent for to see the infant, and found it again

suffering from another attaek of Diarrhœa, but now accompanied with sickness, so that but little medicine or food could be retained; its dejections were pale, slimy, and watery, smelt very offensive; the mother tells me they were now and then of a mixed greenish and cream colour; this state of purging and sickness continued till Wednesday (30th). I never saw, that I can remember, what might be taken for Cholera stools,—she never looked bluish, had no cramps, there was no cold stage or collapse, nor subsequent fever, and she always passed her urine which stained the napkins. From Wednesday (30th) till Saturday (2nd) there was no purging or sickness, she could take but little food, and appeared quite exhausted, and died very quietly on Saturday at 11 a.m., aged 5 months. The mother now tells me that the sickness was the only difference she observed between the last and former illnesses.

'Mrs. ———, whose health was so bad while pregnant with this child, had equally bad health previous to the birth of a male infant, born about three years ago; it was likewise brought up by bottle; it lived only ten months; its lungs and mesentery were diseased; it had cough, and recurring attaeks of Diarrhœa finally carried it off, I might really say, likewise, for I cannot separate these two children's cases,—they exhibit a close relationship to my mind, for we well know that many children are continually carried off, when brought up by hand, by similar disorders. I have been informed by Mrs. ——— that herself and niece were both attacked with severe Diarrhœa the week preceding the infant's last illness; they both recovered however without having taken any medicine, though this disease and Cholera was spreading, and had already become fatal in their neighbourhood. However, during my attendance on the infant, Mrs. ——— had a relapse, with spasms and cramps, and was then treated by me with immediate success. I learn from the mother that the infant's napkins were first soaked in cold water, which was thrown down the sink or privy; the napkins were then properly washed. Having been asked the history of the one infant's illness, I felt I was called on to allude to the

death of the previous one, and to make known the attack which the mother and niece had suffered from before the infant's illness. I doubt not but that the fatal cases of Cholera, which subsequently occurred in the house, one of which was the father of the infant, will be given and reported on by others. I will not therefore further refer to them, and, having given the information you required of me,

I remain, SIR,

Yours, &c.

W. R. ROGERS.

The Rev. H. WHITEHEAD.

It is not for me to discuss the probable difference of opinion which may arise among medical men as to the nature of this child's illness. Whether or not they may choose to decide that "the "accompaniment of sickness" in its third attack (August 28th), and "the relapse of its mother, "with spasms and cramps" on that occasion, indicate the presence of choleraic symptoms, it is for me only to call attention to the coincidence. Neither—although I am aware of two or three pump-water drinkers in Broad Street who were attacked rather sharply with Diarrhœa about a fortnight before the outburst, one of whom afterwards died of Cholera and another recovered from Cholera during the great outburst, and notwithstanding I have long since made mention in print of "one "night in August, when the inhabitants of certain "contiguous streets and courts (the very same "which have just suffered so severely) were very "generally attacked with Diarrhœa,"—can I speak

with sufficient positiveness to connect these attacks, in point of time, with "the previous illness of the "infant on the 14th of August." Even if it should be that we really are on the right track, I know that at this late period it is impossible to unravel the matter in such a way as to meet all objections. I suppose that another epidemic—if unfortunately we should have one—will set all these points at rest. Meanwhile we must be content with securing a prospect of ready attention to one important subject of investigation.

It is worth while however to state that, by recent inquiry, I have ascertained that the dejections of the patients in the third floor of No. 40, owing to great hurry and confusion, were so disposed of that but little could have found its way into the cesspool at all.

My attention has also recently been called to the cross drain from the bottom of the stack pipe of No. 39 (see Mr. York's diagram). There were three deaths from Cholera in No. 39, the attacks being on the 1st, 2nd and 4th September, two of 12 hours duration and one of 24 hours. The point of junction of the two drains will be apparent from the Surveyor's diagram. Whether this fact be considered to increase the difficulty which I have raised will depend upon the precise place and manner of the supposed fatal communication. This is not easy to determine and, even if it could have been ascertained by scientific experiments at

the time of the excavation, cannot now be discovered, owing to the altered state of the drain.

HENRY WHITEHEAD, M.A.

June 5th, 1855.

I had fully intended to avoid making any mention whatever of other streets, being apprehensive, from my Broad Street experience, of being gradually drawn into an intricacy of investigation, to the complete statistical unravelling of which I should certainly have found myself unequal. Yet I feel it necessary to record my opinion, founded upon continuous inquiry, that a like investigation of any other street in the Cholera area would have elicited similar, and even more striking, evidence in favour of the pump hypothesis—more striking because abounding in more marked contrasts than were likely to be met with in the immediate vicinity of the pump.

Having already taken up so much space, I must omit the streets and courts intervening between the centre and the outskirts of this area, and briefly allude only to the outskirts.

Four deaths occurred in the corner house of Brewer Street and Little Windmill Street, and four more in a house towards the north of Poland Street. In each of these houses the use of the Broad Street water in August and September (1854) is beyond a doubt.

Three deaths also occurred in a house close to the dead wall in Noel Street, where the use of this water at that time is more than probable.

These facts, as well as the following, are interesting as tending to disprove the reiterated assertion that the outbreak extended beyond the reach of the pump.

St. Anne's Court (Soho), although the most remote spot of the infected district from the centre of the area, is yet by actual measurement, throughout its whole length, nearer to the Broad

Street pump than to any other. Not having any knowledge of its inhabitants I did not venture to examine them, but the person (himself residing there and by his position well acquainted with the people) who kindly furnished me with its statistics of Cholera, informed me that the Broad Street water was much used there. The distance from the centre of this court to the Broad Street pump is about 240 yards. On the other hand, Cross Street, though actually nearer to another pump, is not so remote as St. Anne's Court from that in Broad Street. As a matter of fact the inhabitants of Cross Street did resort, in August and September (1854), to the Broad Street pump, having, whether with or without reason, conceived a dislike to the water from Little Marlborough Street. A friend of my own, having more than once urged Cross Street as an obvious objection to the water theory, went and made some inquiries in it. When I next saw him he begged to withdraw his objection.

Peter Street affords perhaps as singular an instance as could be found of, what has often been termed, the capriciousness or eccentricity of Cholera. In the smaller portion of it, extending from Green's Court westward to the dead wall, there occurred 19 deaths. In its larger portion, extending from Green's Court eastward to Wardour Street, there was only one death. Now, as a matter of fact, the whole of Peter Street lies, if you measure along the thoroughfare, nearer to the Rupert Street than to the Broad Street pump. But as you approach the dead wall it would take a good judge of distance to decide the point without actual measurement. The house at the corner of Peter Street and Hopkins Street is only four yards nearer to the former than to the latter pump. Consequently its opposite neighbour, No. 23, where 12 deaths occurred, is just so much the nearer still, as the width of a narrow street may render it, to the former. Under these circumstances, especially taking into consideration the circuitous route to Rupert Street, it need not be thought strange if the western population of Peter Street sent to the Broad Street pump. In No. 23 two families supplied nine out of the twelve victims to the disease. A sur-

viving member (the mother) of one of these families, informed me that they had water from Broad Street at dinner the day (August 31) before her three deceased relatives were seized. In our Parish School, on Wandsworth Common, I recently encountered by accident a girl belonging to the other family. Father, mother, and four brothers or sisters, were all swept away by Cholera. She told me that they were in the habit of using the Broad Street water. As you go eastward from this house of course the uncertainty as to the relative distances of the two pumps becomes less and less. Having occasion one day for some other purpose to visit a house only three doors to the east of No. 23, I took the opportunity of questioning a very intelligent man on the point. He said that being of opinion that the Rupert Street pump was the nearest, he always sent to it when he did not use the cistern water. There was, as I have said, only one death in Peter Street eastward of No. 23. Upon inquiry I found that it was in a family among the members of which four nearly simultaneous attacks, three not proving fatal, took place on Sunday morning, September 3rd. They had not habitually used the Broad Street water, but it so happened that on Saturday afternoon, September 2nd, the deceased (a lad) fetched in a large can of it, and began drinking it freely. The father remarked that he would be ill if he drank so much, but the mother said it would do him no harm as it was spring water from Broad Street; upon which they all commenced drinking it, with what result has been mentioned.

The solitary death from Walker's Court was that of a person who was known often to drink the water of an evening. She died in the country, having gone away to escape the pestilence.

I shall only add that Mr. Harrison, Surgeon, of Berwick Street, was an habitual drinker of this water, and in fact did drink it as usual for dinner the day before he was fatally seized. Mrs. Harrison, on whose authority I state this, also drank it and was none the worse for it.

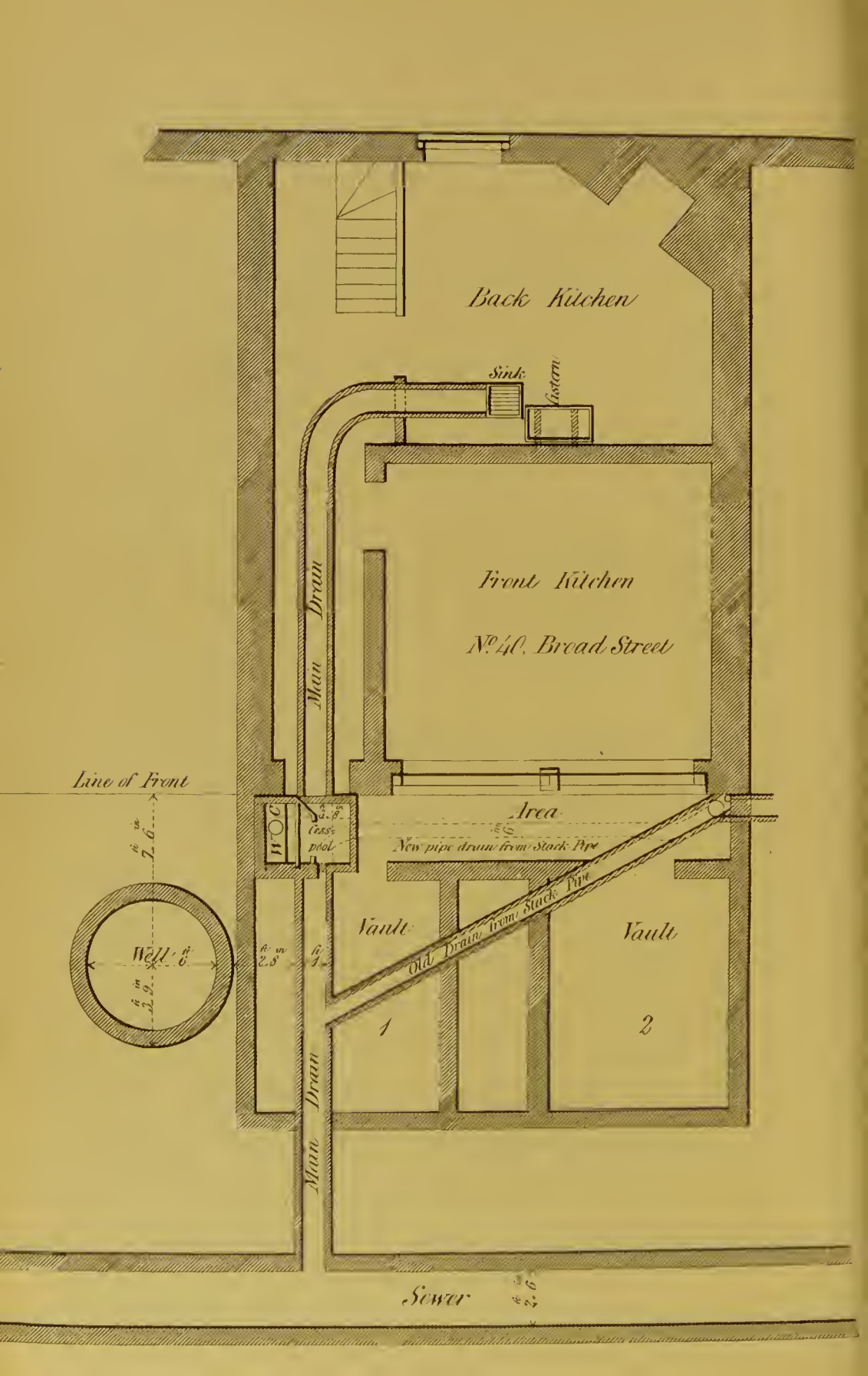
H. W.

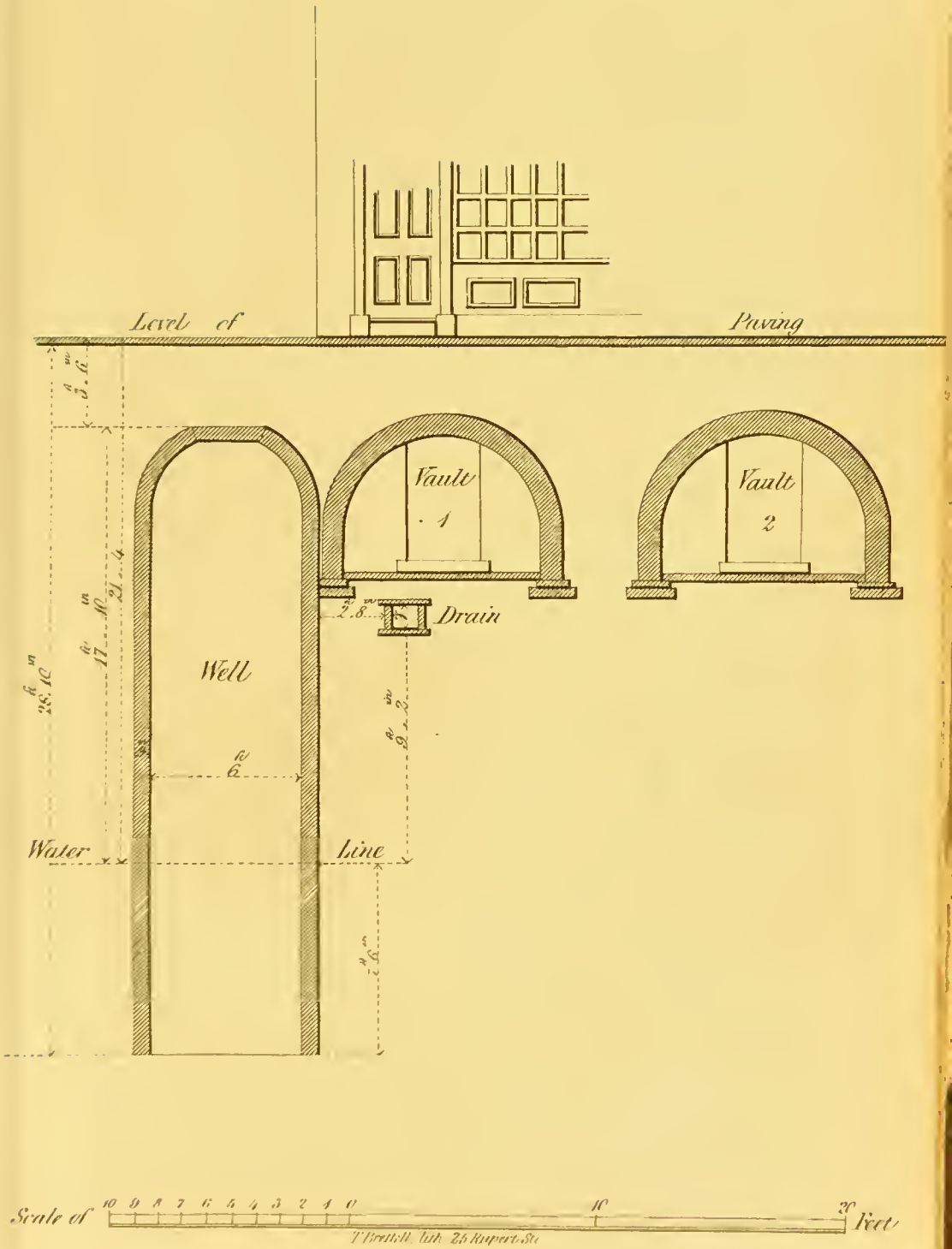
June 5th, 1855.

Mr YORK's REPORT.

The Cholera Inquiry Committee, appointed by St. James's Vestry, having been engaged several months in investigating any causes which might have existed in the autumn of 1854 to induce the propagation of Cholera, among which was the possibility of contamination of well water from defective house drainage, the Secretary was instructed to adopt the best measures for inquiring into, and reporting upon, the condition of the drainage at the house No. 40, Broad Street, it being immediately adjoining the parish pump in that street, which examination having been made at the close of April 1855, the following were found to be the results of his investigations:—

The main drain of the house was opened in the front vault under the street, and was found to be constructed on the old fashioned plan of a flat bottom, 12 inches wide, with brick sides, rising about twelve inches high and covered with old stone. As this drain had but a small fall, or inclination outwards to the main sewer, the bottom was covered with an accumulation of soil deposit about two inches thick, and upon clearing this soil away


Back Kitchen
Sink
Cistern
Front Kitchen
No. 40. Broad Street
Main Drain
Line of Front
Area
New pipe drain from Stack Pipe
Old Drain from Stack Pipe
Vault
Vault
1
2
Well 6'
Main Drain
Sewer


Level of
Paving
Vault
1
Vault
2
Drain
Well
Water
Line
Scale of
Feet

the mortar joints of the old stone bottom were found to be perished, as was also all the jointing of the brick sides, which brought the brick work into the condition of a sieve, and through which the house drainage water must have percolated for a considerable period. Into this drain in the middle of the vault an intersecting smaller drain ran from the front stack pipe at the south-west angle of the front area, bringing the rain water from off the roof of the house, and also forming a communication with the drains of the adjoining house westward (No. 39.)

Upon opening back the main drain, a cesspool intended for a trap, but misconstructed, was found in the area 3ft. 8in. long, by 2ft. 6in. wide, and 3ft. deep, and upon, and over a part of this cesspool a common open privy (without water supply) for the use of the house was erected, the cesspool being fully charged with soil. This privy is formed across the east end of the area, and upon removing the soil the brick-work of the cesspool was found to be in the same decayed condition as the drain, and which may be better comprehended by stating that the bricks were easily lifted from their beds without any, the least force; so that any fluid could readily pass through the work, or as was the case when first opened, over the top course of bricks of the trap into the earth or made ground immediately under and adjoining the end wall eastward, this surface drainage being caused by the accumulation of soil

in, and the misconstruction of the cesspool, which was intended to prevent effluvia and vermin coming into the house from the main sewer in the street, but which in fact it facilitated rather than prevented. This point is worthy of notice, and a reference to the accompanying plan prepared by me will more fully shew its misapplication as well as demonstrate the fatal effect it would have in driving or forcing any deleterious fluid matter into the ground and parish well adjoining, by preventing its running direct into the current of the house drain.

The stone placed in and across this cesspool dipped about three inches into the fluid therein contained, and as the more solid matter became deposited in it, the fluid became reduced in proportion, and when opened on the 23rd of April, 1855, it had reached that state of solidity that hardly any passage for its egress from it was left ; it had in consequence commenced to overflow between the back of it and the end wall of the area, and through any other crevice at the sides of the covering which was composed of saturated rotten boards—the condition of this cesspool covering, together with the solid matter at the bottom, led me to believe that it must have been in this state for many months, but it could not possibly have gone on much longer without total stoppage. All this old drainage has been removed, the cesspool destroyed, and new tubular pipe drains with

cemented joints, and a syphon trapped closet have been substituted. The drain inside of the house which leads from the front area to the back kitchen has not been disturbed, it appears to be used only for the carrying off of waste water from a sink near the cistern, but should the street pump continue to be used hereafter, it will be necessary to have this drain reconstructed.

In connection with the question of how far any communication can exist, and has existed between this defective drainage, and the adjoining parish well which supplies the Broad Street pump, a reference to the accompanying plan and section of the well and drainage of the house will I conceive set the matter at rest.

From the bottom of the house drain down to the water line in the well, a vertical depth of 9 feet 2 inches exists, and from the side of the drain horizontally to the outer side of the brickwork of the well, there is only a space of 2 feet 8 inches, whilst the side wall of the vault adjoining the cesspool actually abuts upon it; thus, therefore, from the charged condition of the cesspool, the defective state of its brickwork, and also that of the drain, no doubt remains upon my mind that constant percolation, and for a considerable period, had been conveying fluid matter from the drains into the well; but lest any doubt should arise upon this subject hereafter, I had two spaces of the brick steining, two feet square each,

taken out of the inside of the well,—the first, thirteen feet deep, from the level of the street paving, the second eighteen feet deep, and a third was afterwards opened still lower, when the washed appearances of the ground and gravel fully corroborated the assumption. In addition thereto the ground was dug out between the cesspool and the well to three feet below the bottom of the former, and its black, saturated, swampy, condition, clearly demonstrated the fact, as did also the small furrowed appearance of the underlying gravel, observed from the inside of the well, from which the fine sand had been washed away during the process of filtration.

In conclusion, I have to state that nearly the same condition was observed in the ground between the street sewer, and the end wall of the vault through which the main drain passes outwards; I presume, therefore, it is manifest to all that, the owner and the occupier of this house had both neglected to improve its drainage by not availing themselves of the facilities afforded them for doing so by the construction and use of the new sewer carried through the western half of Broad Street in the years 1851–2.

JEH^{T} YORK,

Secretary.

14, Marshall Street,
May 1*st*, 1855.

The foregoing Reports were brought up and considered at a meeting of the general Committee, specially convened to receive the same on the 25th of July, 1855, when it was resolved unanimously :—

" That the said Reports be approved, adopted, " and presented to Vestry."

At a Vestry held on Thursday, the 9th of August, 1855, the said Reports were presented by Dr. Lankester, the Chairman of the Sub-Committee, and, after the question had been discussed, were formally adopted and referred back to the Committee to superintend their publication.

F. Crane, T. H. Rice, *Chwˢ*
Thoˢ. Beames, M.A.
Henry Bidgood.
Josᴴ Brown.
J. G. French, F.R.C.S.
Wᴹ Geesin.
Chaˢ. Harrison.
John James, M.R.C.S.
Rᴰ King, M.D.
Edwin Lankester, M.D.
John Marshall, F.R.C.S.
G. W. Sandford.
John Snow, M.D.
Thoˢ. Watkins.
Henry Whitehead, M.A.
Jehᵀ York, *Secᵞ*

APPENDIX A.

QUESTIONS IN VISITOR'S INQUIRY LIST.

Name of the occupier or rate-payer.

Resident or non-resident?

Number of rooms in the house.

Average size of each room.

Number of persons (average) inhabiting each room in August 1854.

In what rooms did Cholera occur in August and September last?

How many cases were there?

At what hour did the attack in each case occur?

How are the rooms ventilated?

Do the top sashes let down?

Condition and position of the privy or water-closet.

Is there any common sewer in the street?

Does the main drain of the house communicate directly into the sewer, or into an intercepting cesspool?

Do the drains of the house emit any stench?

What drinking water was used in August last?

What receptacles exist to contain the supply of water?

How often are they cleaned out?

Is the supply sufficient?

Is the house provided with a receptacle for ashes, dirt, &c.?

How often is it cleaned out?

In what part of the premises is it situated?

Does any offensive place or business exist in the immediate neighbourhood of the house?

Is the basement of the house used as a dwelling?

Is any, and what part, of the house lighted with gas?

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APPENDIX B.

It is here intended to trace the progress of the Epidemic of 1854 throughout the whole Parish of St. James, as a small part of St. Anne's, viz.—the east side of Wardour Street, with St. Anne's Court, St. Anne's Place, and Ship Yard,—a larger portion of St. James's, and less of St. Anne's, being thus taken into account than in the Map prefixed to this Report.

The deaths here noticed are those of Residents only.

The figures in the columns under each day of the month mark the locality and date of attack of 576 fatal cases in which the date of attack has been either calculated from the Registrar's Returns or otherwise ascertained.

The first column to the right hand of this Daily Table assigns to each street its whole number of fatal cases in which the date of attack has been arrived at. At the foot of the Table these same cases are assigned to their several days of attack.

The 2nd, 3rd, 4th, 5th, and last columns to the right hand of the Daily Table shew respectively the total ascertained mortality (including cases of which the date neither of death nor attack is known), the population (according to the Census of 1851, corrected by local knowledge of subsequent increase or diminution), the per-centage mortality, the number of inhabited houses, and number of houses fatally visited, in each street.

Below the Table are given, in contrast to the daily attacks just above them, the daily deaths in St. James's and the included part of St. Anne's, as fully as it has been possible to adjudge them from various sources of information.

Whence it appears that of a total of 703 ascertained fatal cases, assigned (in the second right hand column) to their several localities, there are 127 of which the date of attack, and of these 127 again 51 of which also the date of death, is not known. There can be little doubt however that in by far the greater number of the latter cases the date of attack, and indeed of death likewise, belongs to the first week of September. Some few fatal cases, with precise date of attack unascertained are known to have occurred towards the middle of September in Peter Street, Marshall and Carnaby Streets, Pulteney Place, and Crown Court (Pall Mall).

With the ascertained daily deaths in the above districts are contrasted the daily deaths in the rest of London, reckoned by subtraction from the total daily mortality throughout the whole Metropolis as copied (on the lowest line) from the Report of the Medical Council to the Board of Health which has reached the Committee since the preceding pages have been in type.

| Name of Street, Court, &c. | July | August | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | September | | | | | | | | | | | | | | | | | | |